UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO
INSTITUTO DE GEOLOGIA
DIRECTOR: ING. GUILLERMO P. SALAS

BOLETIN 81

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

POR

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MEXICO, D. F.
1966

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UNIV. NAL. AUTÓN. MÉXICO INST. GEOL., BOL. n. 81, 103 p., 46 figs., 8 láms., 1 tabla (1967)

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

GUSTAVO A. MORALES**

RESUMEN

Treinta y nueve especies de ostrácodos Recientes, que representan veintidós géneros, han sido reconocidas en la Laguna de Términos, Campeche, México. Cinco de estas especies son nuevas: *Actinocythereis triangularis, Leptocythere nikraveshae, Pumilocytheridea ayalai, Xestoleberis rigbyi* y *Cytherura sandbergi.*

Debido a la gran variación en la salinidad del agua, la fauna de ostrácodos está compuesta en su mayoría de especies eurihalinas; sin embargo tres grupos más o menos bien definidos caracterizan (1) el banco de ostiones, (2) la laguna y (3) el delta submarino del interior de la laguna.

Con la información disponible no es posible el evaluar con seguridad el efecto que la vegetación sumergida y la turbidez del agua puedan tener en la distribución y abundancia de los ostrácodos. Cerca de la mitad de los ostrácodos colectados en la Laguna de Términos fueron encontrados en las estaciones alrededor del contacto de la zona de agua clara con vegetación sumergida y la zona de agua turbia sin vegetación. El ambiente más propicio para el desarrollo de los ostrácodos parece ser el resultado de la combinación de las plantas sumergidas y los materiales nutritivos que son acarreados por los ríos en la parte oeste de la laguna.

Se ha confirmado que los requisitos ecológicos varían considerablemente de una a otra especie dentro del mismo género y que el uso de un solo género como indicador de ambiente en trabajos paleocológicos puede resultar en errores.

ABSTRACT

Thirty-nine species of Recent ostracodes representing twenty-two genera were recognized in samples from Laguna de Términos, Campeche, southeastern Mexico. Five of these species are new: *Actinocythereis triangularis, Leptocythere nikraveshae, Pumilocytheridea ayalai, Xestoleberis rigbyi and Cytherura sandbergi.*

Because of the wide range of water salinity the ostracode fauna consists mostly of euryhaline species; three moderately well-defined ostracode assemblages, however, characterize the (1) oyster bank, (2) lagoon, and (3) washover delta.

From the data now available, the influence of sumerged vegetation and turbidity of water on ostracode distribution and abundance cannot be evaluated reliably. Approximately half of the ostracodes found in Laguna de Términos are concentrated in the stations fringing the contact of the zone of clear water rich in submerged vegetation and the zone of turbid water

* This paper was presented as a dissertation in 1965, in the Graduate Faculty of Louisiana State University in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Geology.

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poor in submerged vegetation. The most propitious environment for the development of ostracodes here seems to result from the combination along this line of the submerged plants and the nutrients brought in by the rivers in the western portion of the lagoon.

It was confirmed that the ecologic requirements differ widely from one species to another within a genus so that using a single genus as environment indicator may result in inaccuracies in paleoecologic work.

RÉSUMÉ

Trente neuf d'espèces d'ostracodes Récent representant vingt deux genres étaient reconnues dans la Laguna de Términos, Campeche, Mexique. Cinq de cettes espèces sont nouvelles: *Actinocythereis triangularis, Leptocythere nikraveshae, Pumilocytheridea ayalai, Xestoleberis rigbyi* et *Cytherura sandbergi.*

A cause de la grand variation de la salinité d'eau la faune d'ostracodes est composé pour la plus part d'espèces eurihalines; trois groupes plus ou moins bien défini caracterisent (1) le banc d'huîtres, (2) la lagune, et (3) la delta sous-marine à l'interieur de la lagune.

Avec les informations que nous possedons il n'est pas possible d'evaluer exactement le rôle que la végétation sous-marine et la turbidité d'eau jouent dans la distribution et l'abondance d'ostracodes. À peu près moitié d'ostracodes collectées dans la Laguna de Términos se sont trouvées dans les environs du contact de la zone d'eau claire avec végétation sous-marine et la zone d'eau turbide sans végétation. Il parait que la condition la plus favorable pour le développement d'ostracodes consiste de la combination des plantes sous-marines et des materiels nutritives apportés par les rivières dans la partie occidentale de la lagune.

Il a eté confirmé que les conditions ecologiques varient considerablement d'une espèce al'outre dans le même genre et qui'l utilisation d'un seul genre comme l'indicateur d'environement dans les travailles paléo-écologiques peut resulter en erreures.

ZUSAMMENFASSUNG

Neununddreissig Arten rezenter Ostracoden aus zweiundzwanzig Gattungen wurden in Proben aus der Laguna de Términos, Campeche, im südösstlichen Mexiko identifiziert. Darunter sind fünf neue Arten: *Actinocythereis triangularis, Leptocythere nikraveshae, Pumilocytheridea ayalai, Xestoleberis rigbyi,* und *Cytherura sandbergi.*

Wegen der starken Schwankungen des Salzgehaltes im Wasser besteht die Ostracodenfauna hauptsächlich aus euryhalinen Arten; es sind jedoch drei verhältnismässig gut definierte Ostracoden - Gruppierungen zu unterscheiden, die für (1) die Austernbank, (2) die Lagune und (3) das marine Delta in der Lagune characteristisch sind.

Die Beobachtungsdaten reichen nicht aus, um den Einfluss von Unterwasservegetation und Wassertrübung auf Verteilung und Haüfigkeit der Ostracoden zuverlässig zu beurteilen. Etwa die Hälfte der in der Laguna de Términos gefundenen Ostracoden ist konzentriert auf Probenahmestellen aus der Kontaktzone zwischen den Bereichen des klaren, vegetationsreichen Wassers einerseits und des trüben, vegetationsarmen Wassers andererseits. Die günstigsten Umweltsbedingungen für die Ostracoden-Entwicklung resultieren hier offenbar aus der in der erwähnten Kontaktzone vorhandenen Kombination von Unterwasservegetation und Nährstoffzufuhr durch die Flusse im westlichen Teil der Lagune.

Es wurde belegt, dass innerhalb einer Gattung die ökologischen Erfordernisse von Art zu Art stark wechseln. Dies kann zu Ungenauigkeiten in paläo-ökologischen Arbeiten führen, wenn jeweils nur eine Gattung als Umwelts-Indikator benutzt wird.

SOMMARIO

Trenta nove specie di ostrocodi Recente rappresentanti venti due generi sono stati riconosciuti nei campioni provenienti dalla Laguna de Términos, Campeche, nel Sud-est Messico. Cinque di queste specie sono nouve *Actinocythereis triangularis, Leptocythere nikraveshae, Pumilocytheridea ayalai, Xestoleberi rigbyi,* ed *Cytherura sandbergi.*

Per causa alla vasta portata della salinitá gli ostrocodi consistono principalmente di specie *euryhaline;* tre concorsi di ostrocodi moderatamente definiti tuttavia caratterizzano (1) il banco di ostriche (2) la laguna ed (3) il delta inverso.

Dai dati ora disponibili l'influenza della vegetazione del sottosuolo e la torbidita dell'acqua sulla distribuzione et abbondanza degli ostrocodi non si puó accuratamente valutare. Approssimatamente la mettá degli ostrocodi trovati nella Laguna de Términos sono concentrati nelle stazioni che orlano il contatto nella zona dell'acqua chiara e ricca di vegetazione sommersa e nella zona d'acqua torbida mancante di vegetazione sommersa. L'ambiente propizio per lo sviluppo degli ostrocodi appare di risultare dalla combinazione di piante sommerse e dei nutrienti che if fiumi recano dalla parte occidentale della laguna.

É stato confermato che i richiedimenti dell'ecologia differiscono vastamente da una specie all'altra nello stesso genere cosí che usando generi unici come indicatori dell'ambiente potrebbe risultare nell'inesattezza del lavoro paleoecologico.

Заключение

Тридцать девять видов современных остракод, представляющих собой двадцать два рода, были опознаны в пробах взятых из лагуны де Терминос, в штате Кампече, в юго-восточной Мексике.

Пять из этих видов новые: *Actinocythercis triangularis, Leptocythere nikraveshae, Pumilocytheridea ayalai, Xestoleberis rigbyi, Cytherura sandbergi.*

По причине широкой амплитуды солености воды фауна остракод состоит в большинстве из видов euryhaline; три хорошо установленных группы остракод характеризуют (1) устричник, (2) лагуну, (3) наносную дельту.

По имеющимся в настоящее время данным, не может быть точно определено влияние донной растительности и мутности воды на распределение и изобилие остракод.

Приблизительно половина остракод, найденных в лагуне де Терминос, сосредоточена в местах взятия проб на границе зоны соприкосновения прозрачной воды, богатой донной растительностью с зоной мутной воды, в которой мало донной растительности.

Самая благоприятная среда для развития остракод здесь, повидимому, по линии донных растений и питательных веществ нанесенных реками в западную часть лагуны.

Было установлено что экологические потребности сильно изменяются, один вид от другого, в пределах (среди) того же самого рода, следовательно, пользуясь примером одного рода как признаком окружающей среды, может привести к неточностям в палеоэкологических работах.

INTRODUCTION

The Laguna de Términos (Fig. 1) on the Gulf Coast of Mexico has received considerable attention by Mexican scientists in the past few years. At the present time the foraminifers, diatoms, and micro-molluscs are being studied intensively by the personnel of the Instituto de Geología of the Universidad de México as a part of a broad 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 of the Instituto de Geología. The foraminifers, diatoms, and micro-molluscs, as well as the physical aspects of the sediment and the environment have been described from the same samples used in the present study. This report deals with the ostracodes, their distribution in Laguna de Términos, and the possible influence of the environment on the relationships and assemblages of these crustaceans.

I am deeply grateful to H. V. Howe, G. E. Murray, J. K. Rigby, and W. A. van den Bold for their unflagging interest and assistance. These added immeasurably to the pleasure and satisfaction of the study. I am also grateful to A. Ayala-Castañares of the Instituto de Geología for suggesting the problem and supplying the samples; to P. A. Sandberg for comparing some of my material with the types deposited in the United States National Museum; to S. Grossman and R. M. Jeffords for their critical review of the manuscript; to L. G. Nichols for his patience and skill in taking the photographs for the plates that accompany this report; to V. E. Foss and C. Lignos for assistance in typing report drafts.

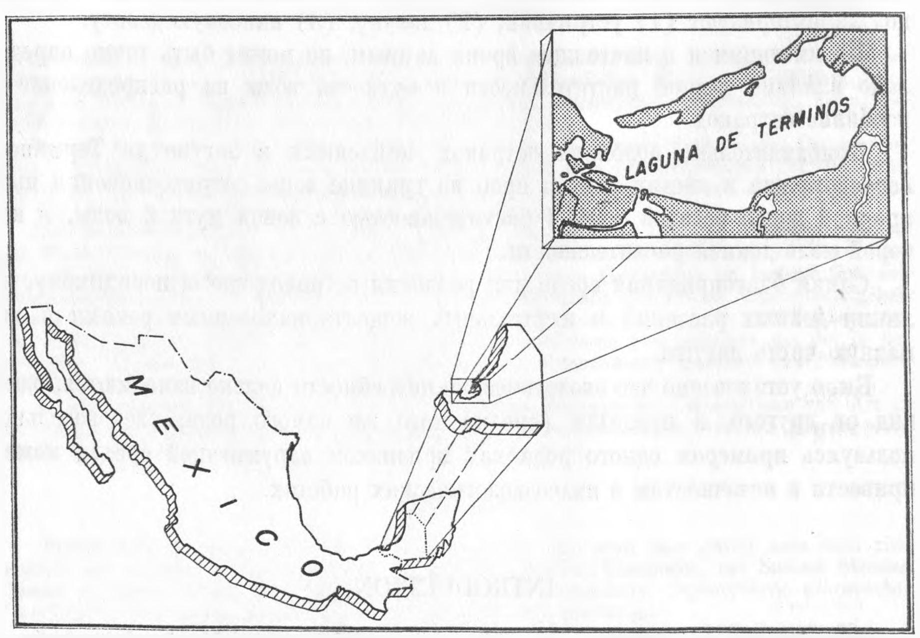

Fig. 1. Location map of Laguna de Términos

Area of Study

Laguna de Términos (Fig. 2) is a littoral lagoon indenting the Gulf Coastal Plain in the western portion of 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 (Fig. 2) Río Palizada, Río del Este, Río Candelaria, and Río Chompín. These streams, however, empty into smaller estuaries which in turn are connected to Laguna de Términos by small passes.

Sampling

The present study is based on material obtained by A. Yañez and A. Zarur in 1960. It includes 205 samples collected along 23 traverses; 118 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 of the lagoon.

At stations where the water 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 is equal to a total volume of ten cubic centimeters. For this study the uppermost one centimeter of the core was utilized. At stations where water 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 was used for sedimentary analyses.

Each ten-cubic-centimeter sample of sediments was placed in a jar containing water from the sample site. A five percent solution of formaldehyde was added to preserve the protoplasm of the living specimens, and sodium borate was added to neutralize the acidity of the formaldehyde and to avoid destruction of the oscracode tests. Samples were treated at the laboratory with a concentrated solution of Rose Bengal to stain the protoplasm of the specimens that had been alive at the time of sampling.

Ostracode Occurrence

All ostracodes were picked from the original ten cubic centimeters of wet sediments and mounted by conventional micropaleontological techniques. Occurrences of species were recorded in terms of single valves and these then were

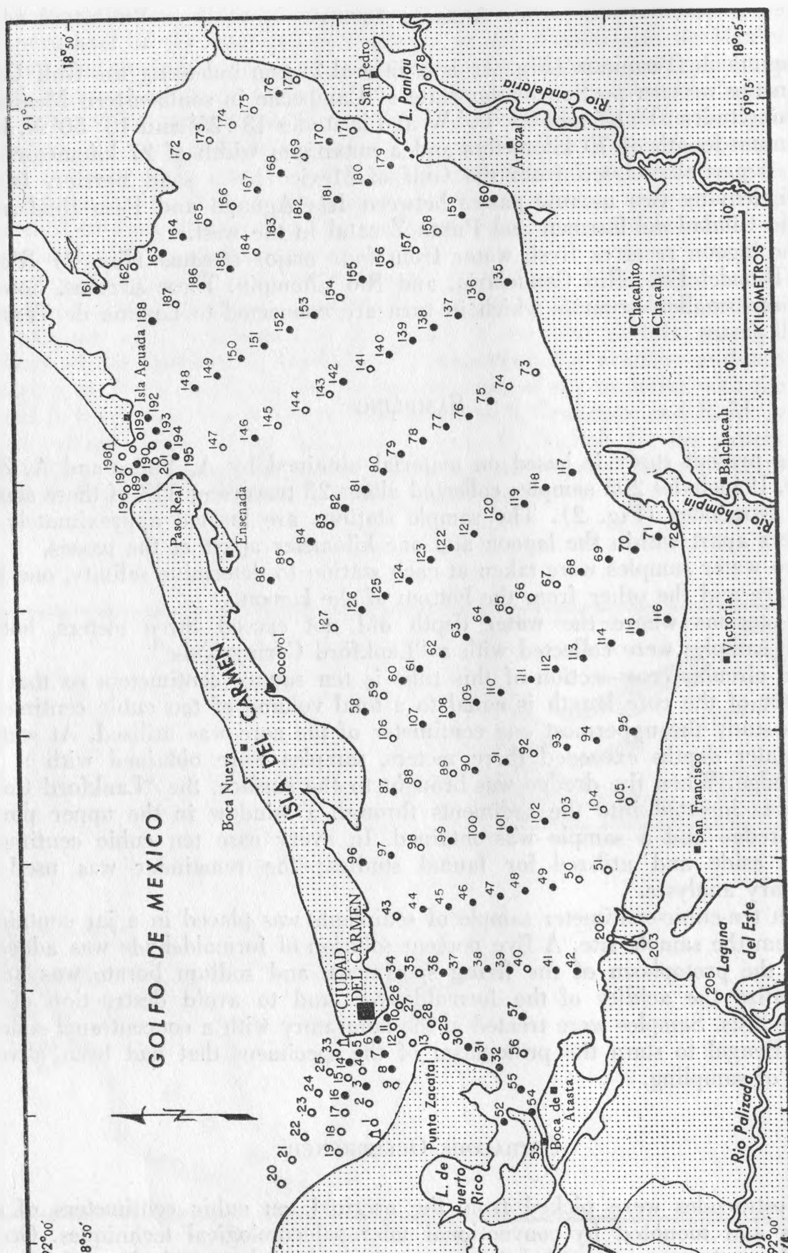

Fig. 2. Collecting localities. Closed circles: samples with ostracodes. Open circles: samples without ostracodes.

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. On the distribution maps, the first number shown at each station represents the number of valves. The percentage following this number expresses the relationship between the number of valves found and the total population for the station. A chart summarizing this information is given at the end of this report.

The figured specimens, which have the letters IGM preceding the numbers (as IGM 2760-2763 Mi), have been deposited in the micropaleontology collection of the Instituto de Geología, Universidad Nacional Autónoma de México. Unfigured specimens indicated by the letters H.V.H. preceding the numbers (as H.V.H. 8118-8119) have been deposited in the Henry V. Howe Collection at Louisiana State University, Baton Rouge, Louisiana.

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 Términos range from 1 to 514. The populations are, for the most part, rather small; notable exceptions to this are stations 45, 58, 90, and 189.

ENVIRONMENTAL FACTORS

Temperature

Figure 3 shows the distribution of the surface temperature of the water in Laguna de Términos. 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 pattern in the distribution of temperature probably reflects daily changes in temperature; the differences which were noted may very well be related to the time of the day during which the readings were taken.

According to data obtained by the Mexican Meteorologic Service during the past eight years, the temperatures in Laguna de Términos 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 25 and 32 degrees Centigrade.

Depth

Laguna de Términos ranges in depth from less than one to five fathoms but is mostly between one and two fathoms deep. The greater depths occur in the passes at the eastern and western ends of Isla del Carmen (Fig. 4).

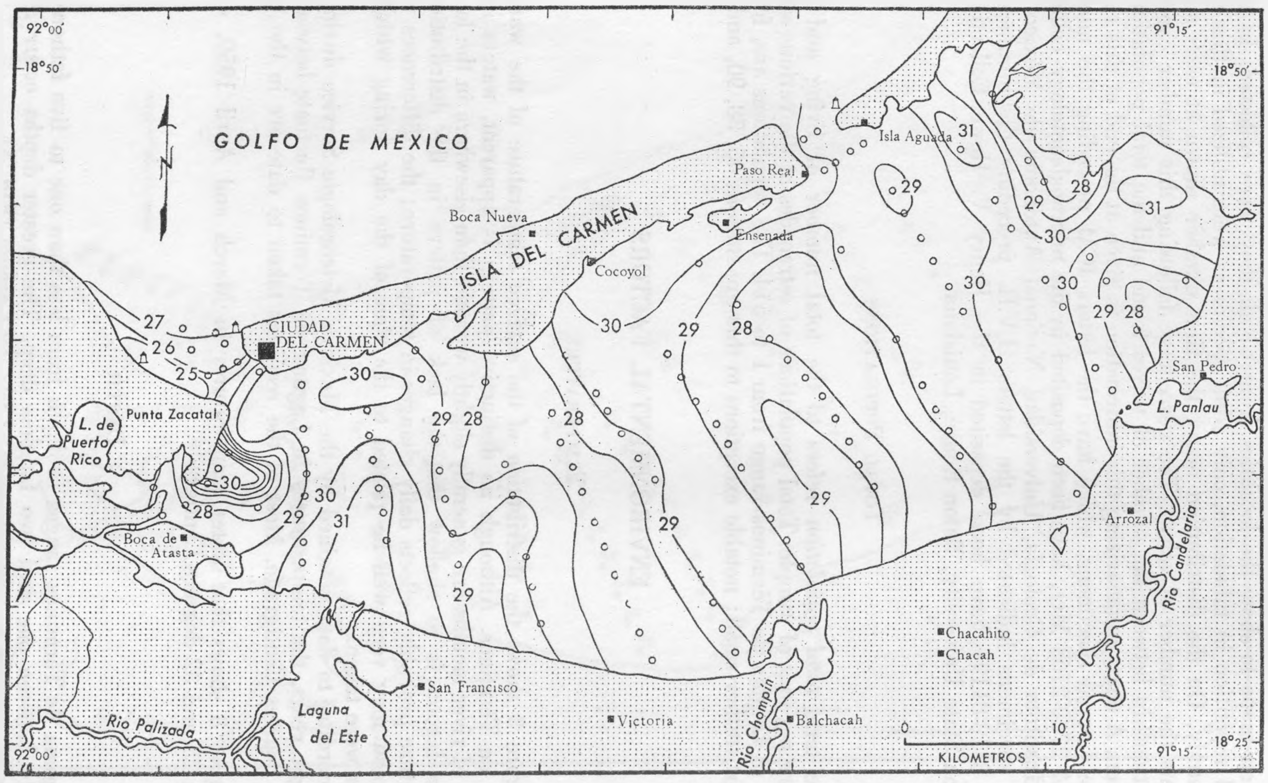

Fig. 3. Distribution of surface-water temperatures in degrees centigrade. (After Yáñez, 1963).

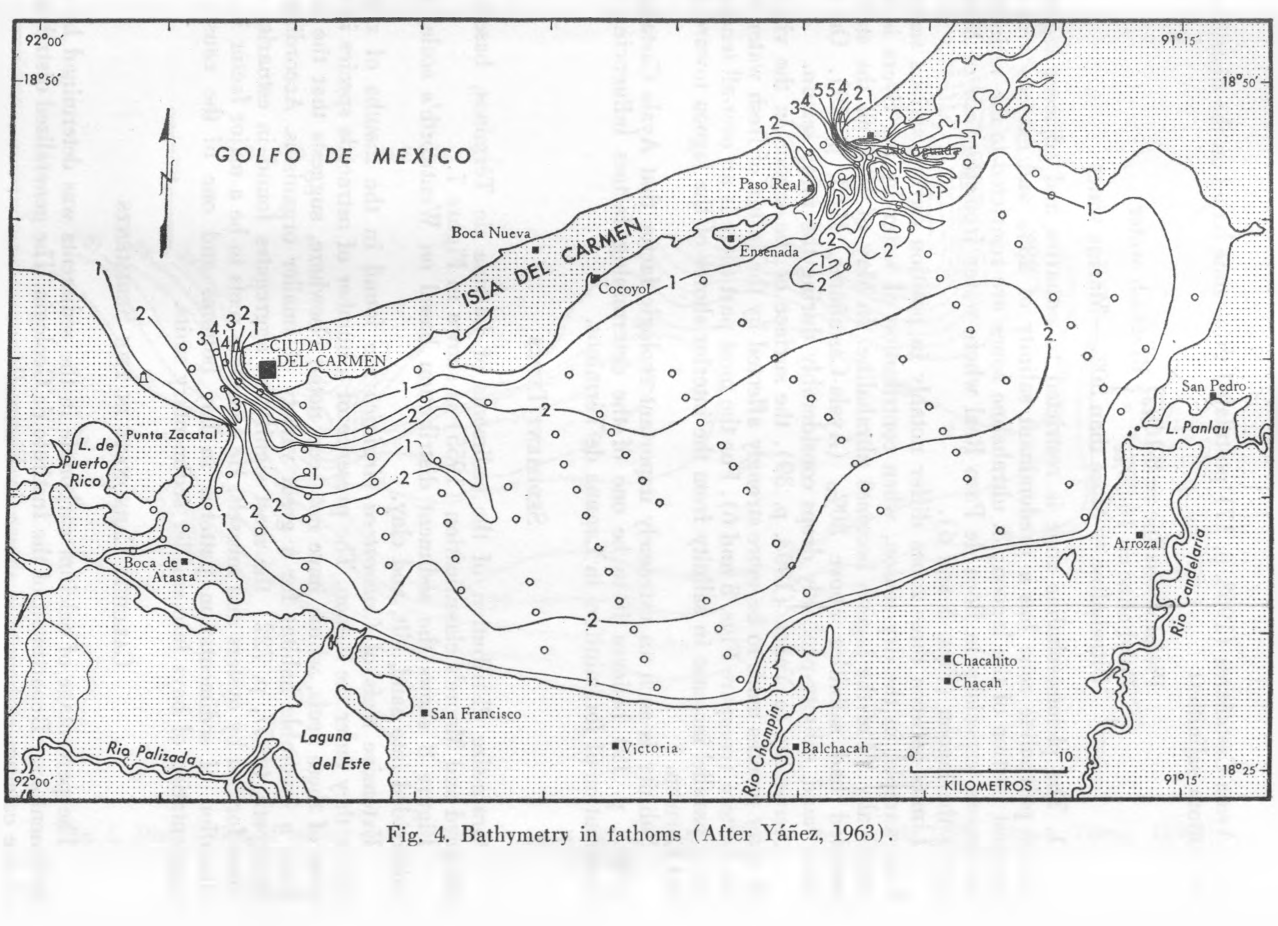

Fig. 4. Bathymetry in fathoms (After Yáñez, 1963).

Salinity

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

Pleiomesohaline = 8-16‰ } Brackish water
Polyhaline = 16-30‰ }
Ultrahaline = More than 30‰—Marine water

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

Limits between these zones differ notably in position during various seasons. For example, in the dry season, when contribution of water by the rivers is less, practically all of the lagoon becomes ultrahaline. In May of 1963 all the stations sampled had salinities above 30‰ (Ayala-Castañares, 1963, p. 19). On the other hand, salinity probably drops considerably during the rainy season.

According to Yañez (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 Castañares (1963, p. 19) believes it to be one of the determining factors influencing the distribution of foraminifers in Laguna de Términos.

Sediment Types

Grain-size distribution of the sediments of Laguna de Términos, based on Shepard and Moore's classification (1955) is shown in Figure 7.

Figure 8 shows the sediment distribution based on Wentworth's scale, and subdivided into sand, silt, and clay.

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 Hedgpeth (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 segmentation of bays into smaller sedimentary units.

Calcium Carbonate in the Sediments

The percentage of calcium carbonate in the sediments was determined by the Sedimentology Department of the Instituto de Geología. The generalized distribution of the calcium carbonate is shown in Figure 9.

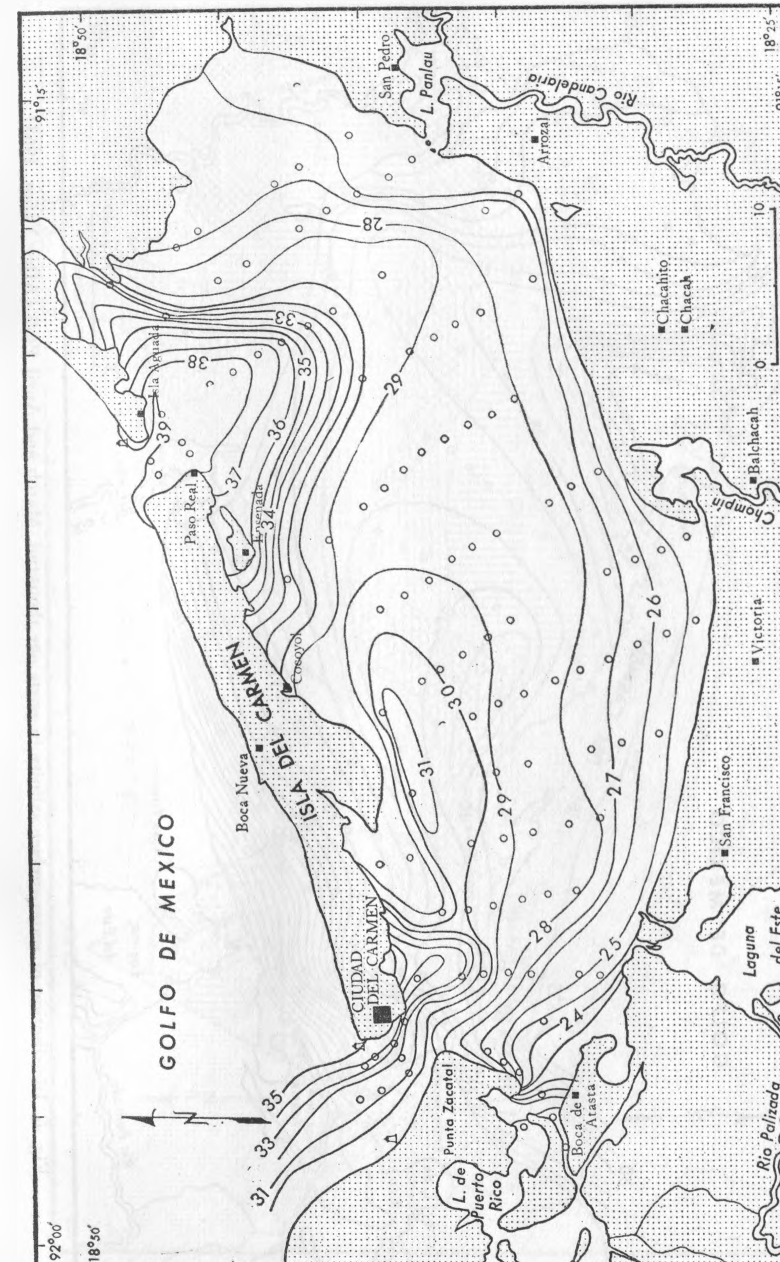

Fig. 5. Distribution of bottom-water salinity in parts per thousand, March and April, 1959. (After Yáñez, (1963).

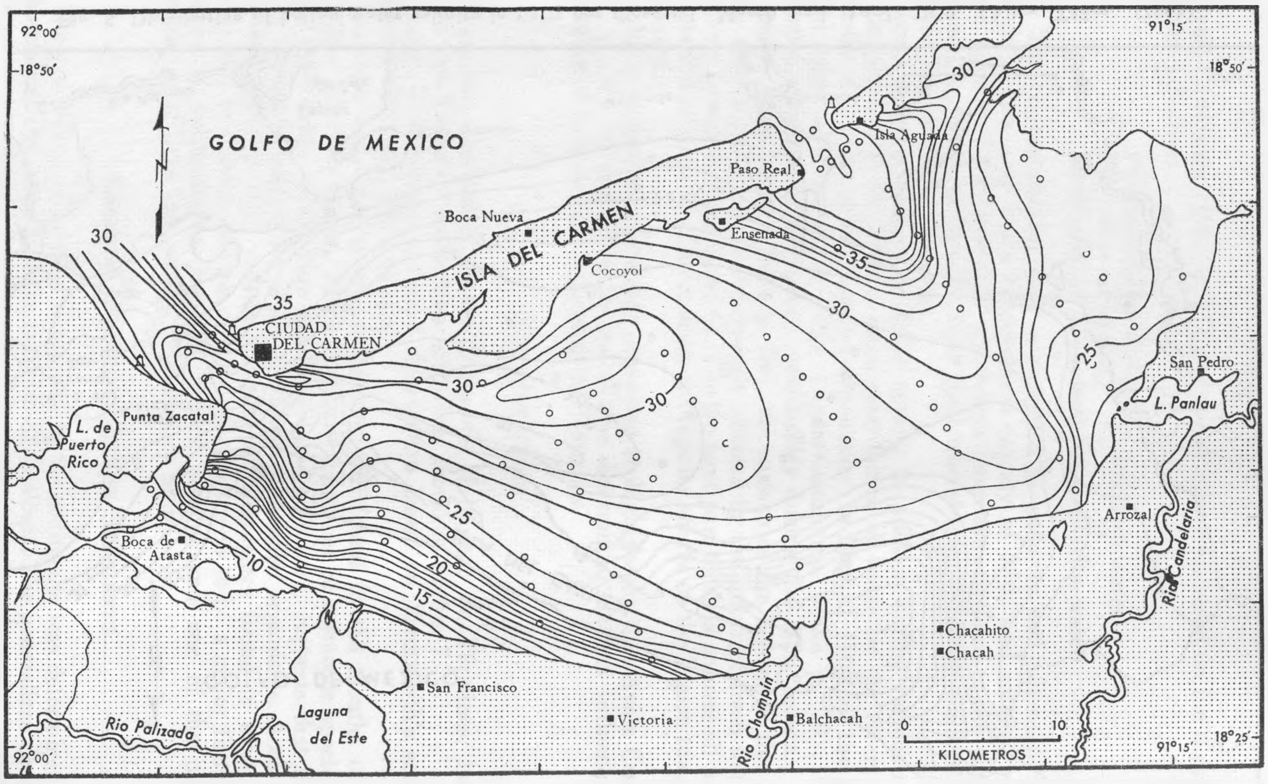

Fig. 6. Distribution of water-surface salinity in parts per thousand, March and April 1959 (After Yáñez, 1963).

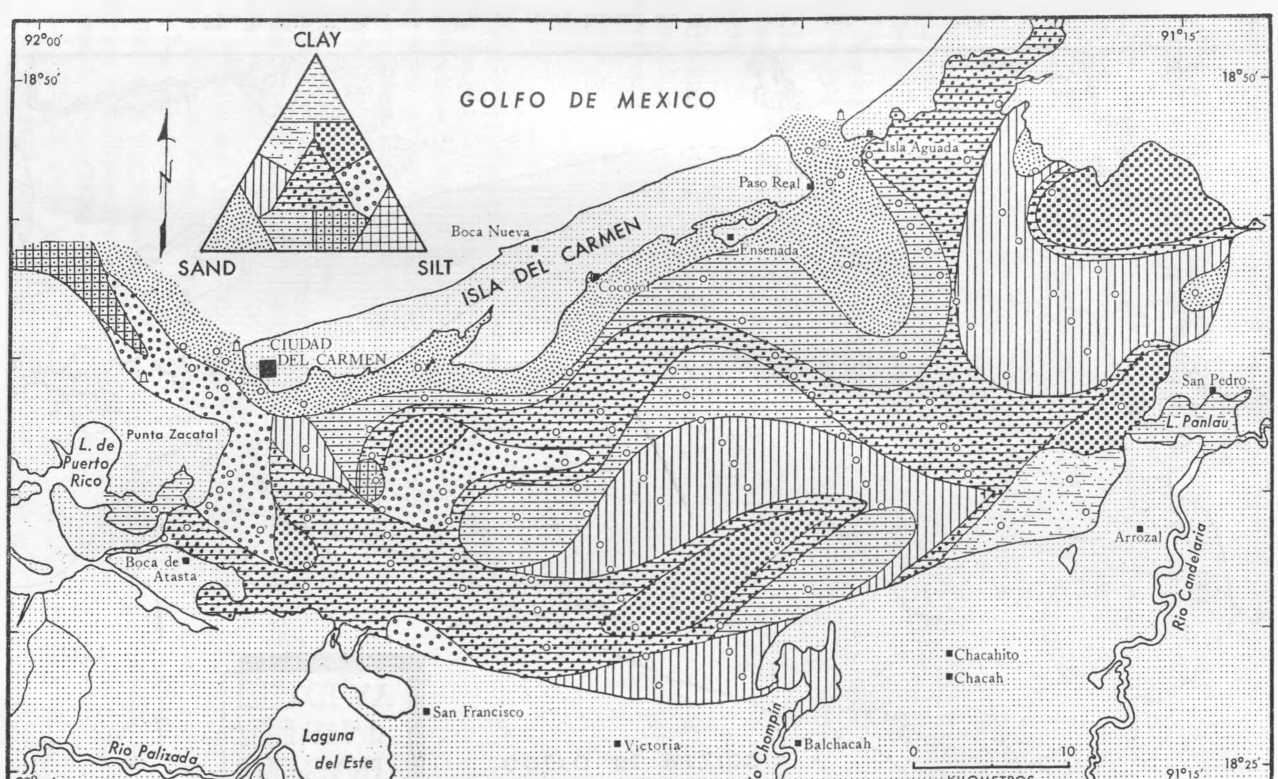

Fig. 7. Grain-size distribution based on Shepard and Moore's classification (After Yáñez, 1963).

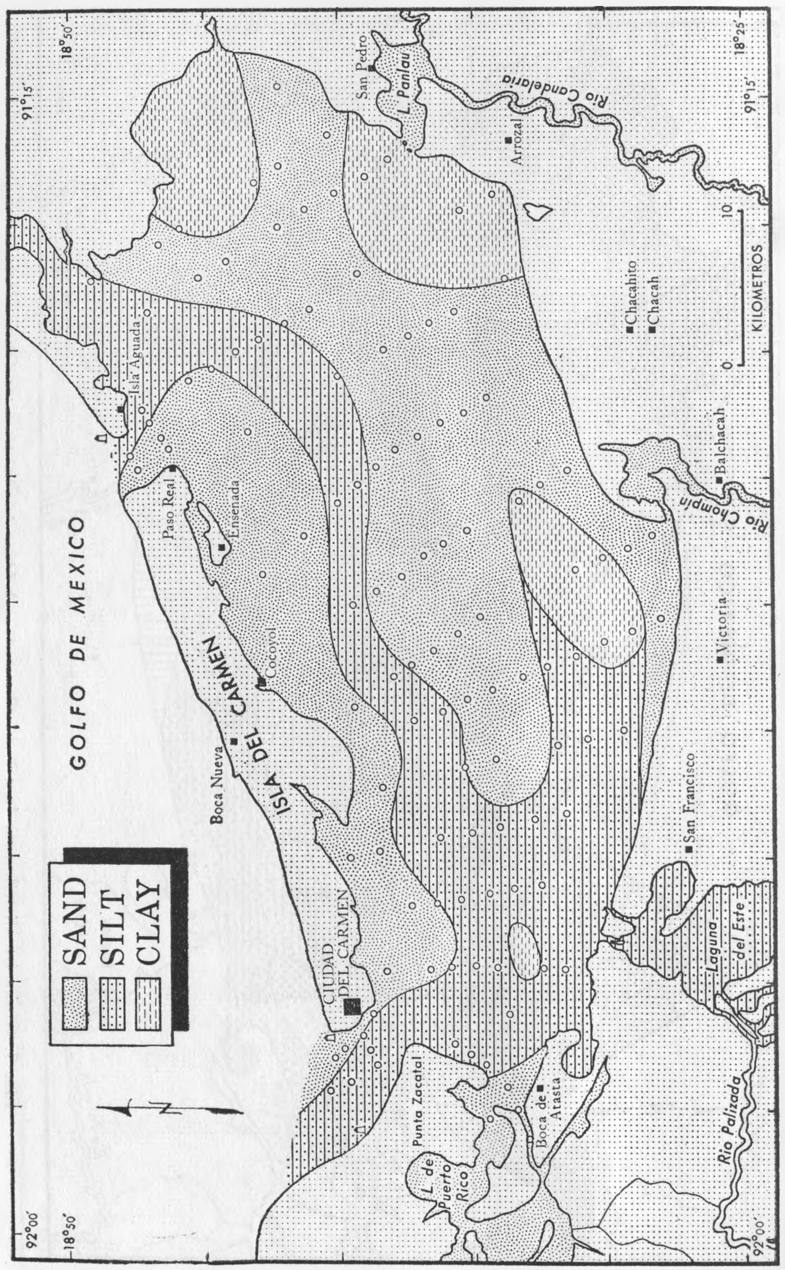

Fig. 8. Distribution of sediment types based on Wentworth's scale (After Yáñez, 1963).

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 through Boca de Paso Real.

2. The calcium carbonate distribution pattern in the Laguna de Términos suggests that little or no calcareous material is introduced by the waters of the Río Candelaria even though this stream flows through the 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 Términos carry in suspension terrigenous materials poor in calcium carbonate, thereby affecting the distribution of turbid waters and creating a distinct decrease in the calcium carbonate content in the sediments in the western portion of the lagoon.

4. Appreciable amounts of calcium carbonate seem to be trapped by the submerged vegetation growing in the eastern region of Laguna de Términos.

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

6. Sediments with the highest percentages of calcium carbonate are located in the southern portion of Isla del Carmen and parts of Boca de Paso Real. They consist of sand 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 Términos carry in suspension great amounts of fine terrigenous material. Río Chompín, in the southwestern portion, also contributes some terrigenous materials but in smaller scale. Río Candelaria and other rivers in the eastern portion of the lagoon have clear waters 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 Términos. 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 *Diplanthera wrightii;* the zone of turbid waters is for the most part devoid of vegetation (Fig. 10).

The limits of these zones, which are not well defined, vary in the different seasons of the year depending on the influx of the river water and the movement of water in the lagoon.

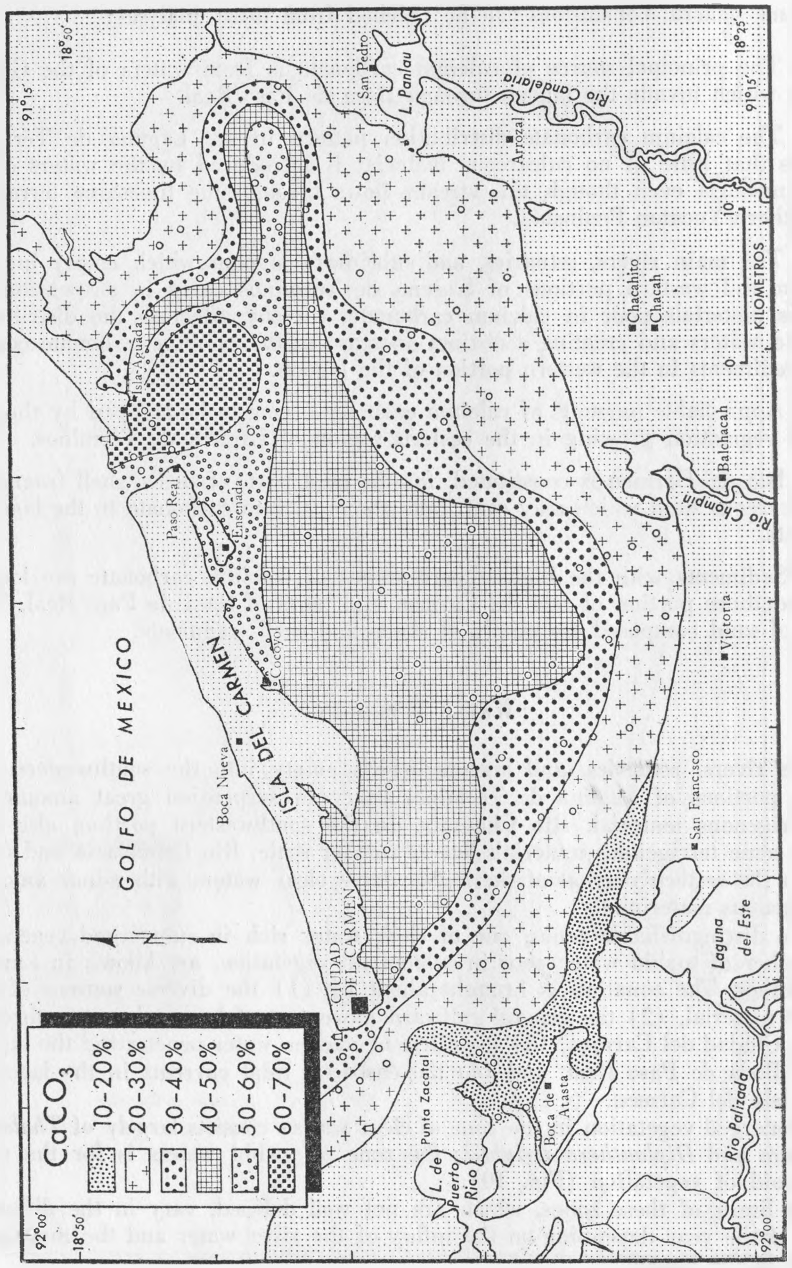

Fig. 9. Distribution of calcium-carbonate content in the sediments (After Yáñez, 1963).

SUBMERGED VEGETATION

Zarur (1961), in his reconnaissance report on Laguna de Términos, 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 monocotyledonous plants: *Thalassia testudinum, Diplanthera wrightii,* and *Halophila engelmanii.*

Thalassia testudinum is the most abundant of these three forms and is probably the most important, geologically, in its role of sediment collector. *Diplanthera wrightii* was found at numerous localities usually in association with *T. testudinum. Halophila engelmanii* 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 calcium carbonate 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.

Bernatowics (1952) in his study of Bermuda found *Diplanthera 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, Hedgpeth, Ginsburg and Lowenstam, Kornicker, and Hoskin with the data obtained by the personnel of the Instituto de Geología in Laguna de Términos, certain general conclusions can be reached:

1. The distribution of *Thalassia testudinum* and *Diplanthera 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 marine portions of the lagoon.

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 water 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-

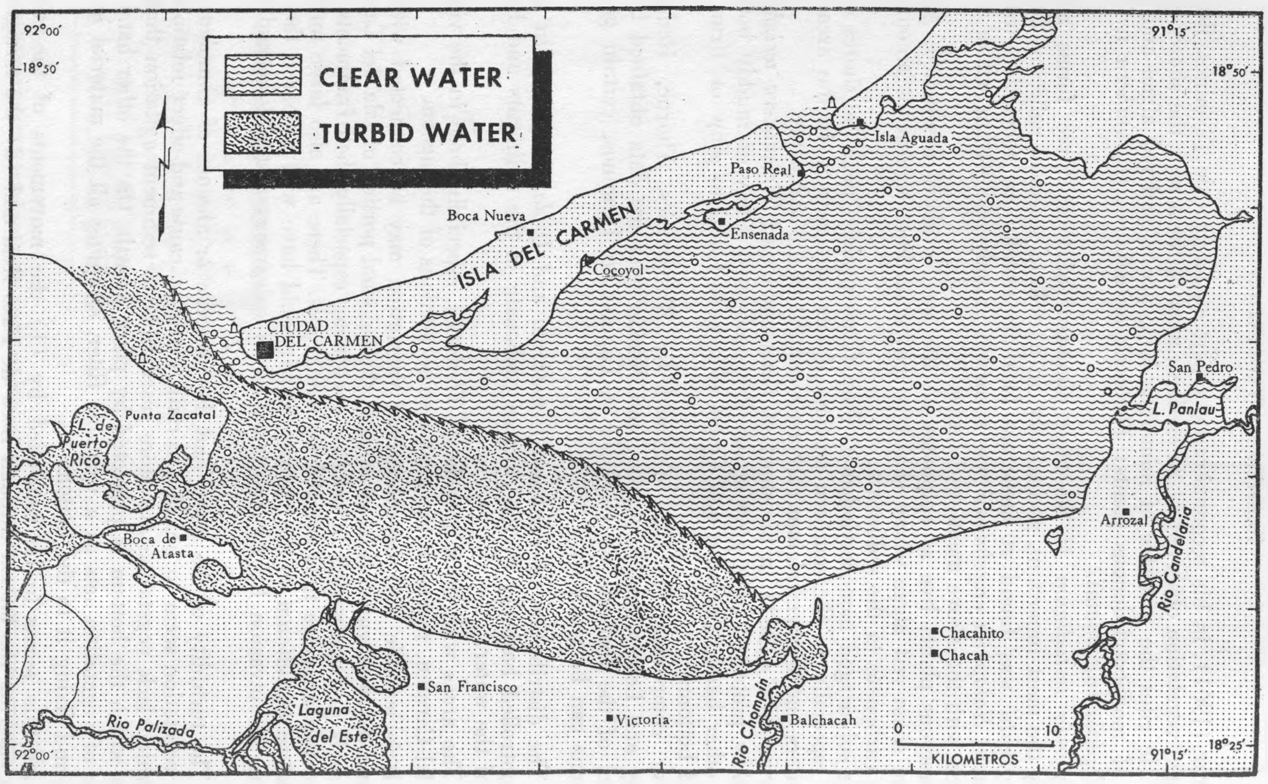

Fig. 10. Generalized distribution of clear and turbid waters (Modified after Ayala-Castañares, 1963).

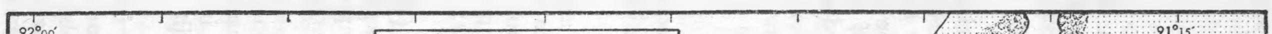

Fig. 11. Mangrove distribution (After Ayala-Castañares, 1963).

rich water of the Río Palizada, which empties into the Gulf of Mexico through Boca de Ciudad del Carmen.

Mangroves

Laguna de Términos is surrounded, for the most part, by mangroves. They also extend around the periphery of the estuaries and subsidiary lagoons (Fig. 11). According to Mr. Bruce Thom (personal communication) three species of mangroves live in this region: *Rhizophora mangle, Avicennia nitida,* and *Luguncularia 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. *Luguncularia racemosa* is for the most part found away from the shores in less moist substrates. The zonation of mangroves is affected markedly by the nature of the substrate, currents, sediment types, salinity, and rate of deposition.

ENVIRONMENTS OF DEPOSITION

Laguna de Términos has been subdivided into areas which present sedimentary conditions distinctive enough to be separated from each other (Fig. 12). Seven divisions have been made; their description and characteristics follow:

1. *Interior areas of relatively uniform deposition.* These areas lack abrupt or appreciable changes in sedimentary processes and result from relatively uniform ecologic conditions. Terrigenous materials are rare, commonly less than two percent of the coarse fraction of the samples; this fraction being composed mostly of tests of microorganisms, foraminifers, ostracodes, and micro-molluscs; the sediments are restricted to sand-size particles.

2. *Marginal areas affected by river discharge.* According to Yañez (1963, p. 42) the lack of strong dynamic processes characterizes deposition of the sediments in this area where the sediments are poorly sorted. Sediments are composed, for the most part, of equal amounts of sand, silt, and clay. Abundant organic matter occurs in 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 silt and clay 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 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 water of the lagoon. The sediments include coarse to fine detritus and may include non-clastic and organic materials. Relatively coarse sand composed of shell fragments occurs in the channels, whereas silt and clay are found in the quiet water. Some of the finer materials probably are flocculated by the action of the salts dissolved in the sea water, and thus form mud composed predominantly of calcareous clay.

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. The grain-size analyses of samples from this area, however, 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 composed of shells. In the smaller channels with nearly still water, silt and clay are abundant, whereas silt is predominant on the margins of the delta.

7. *Oyster banks.* These areas are affected significantly 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.

ECOLOGY

In the next few pages the ecology of all species identified during this study is summarized (Table 1). 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 specie.

Actinocythereis triangularis sp. nov. seems to have a marked preference for terrains whose sediments contain 40 to 50 percent calcium carbonate. The species decreases markedly in abundance away from these areas; the decrease being most abrupt where the carbonate content is highest. In addition, *A. triangularis* seems to prefer areas of clear water 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 sligthly, the known range being from 28 to 31‰. Furthermore, its most favorable habitat appears to be concentrated at a depth of approximately two fathoms. Although the greatest number of specimens 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 calcium carbonate content of the sediments ranges from 30 to 50 percent, (2) in regions of uniform sedi-

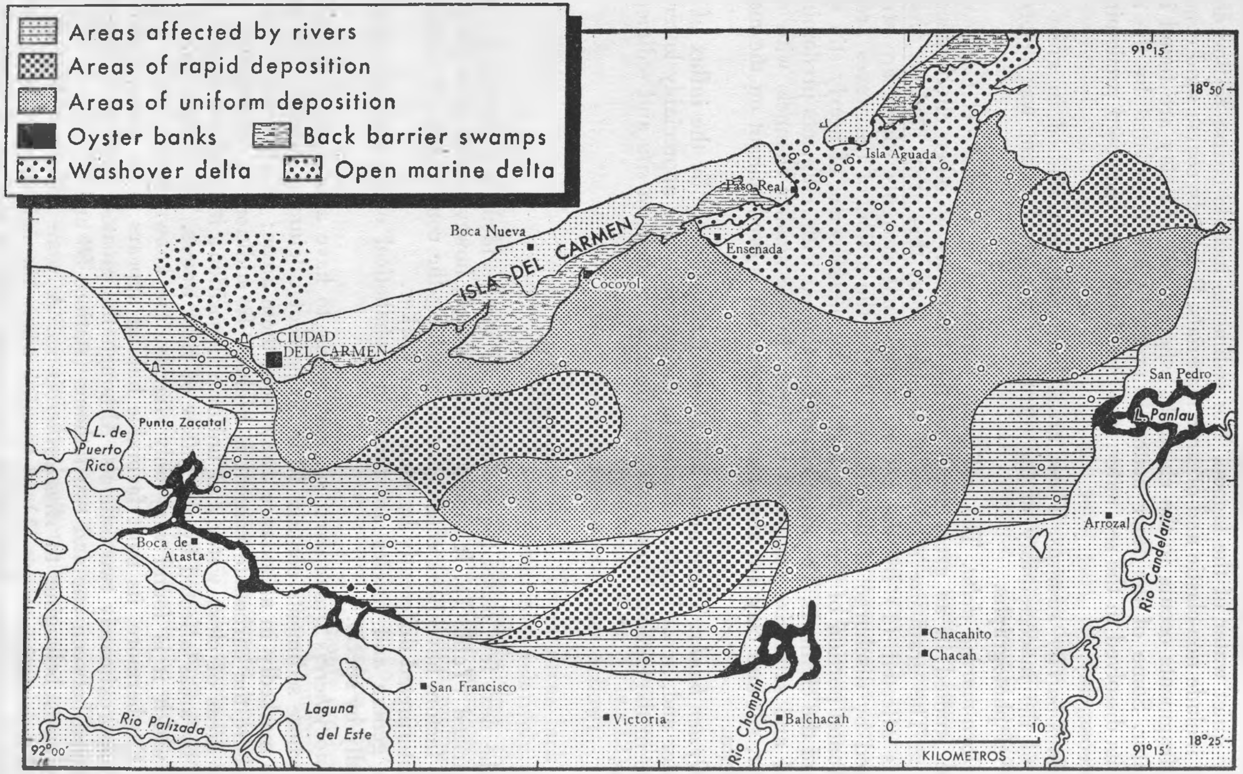

Fig. 12. Environments of deposition (After Yáñez, 1963).

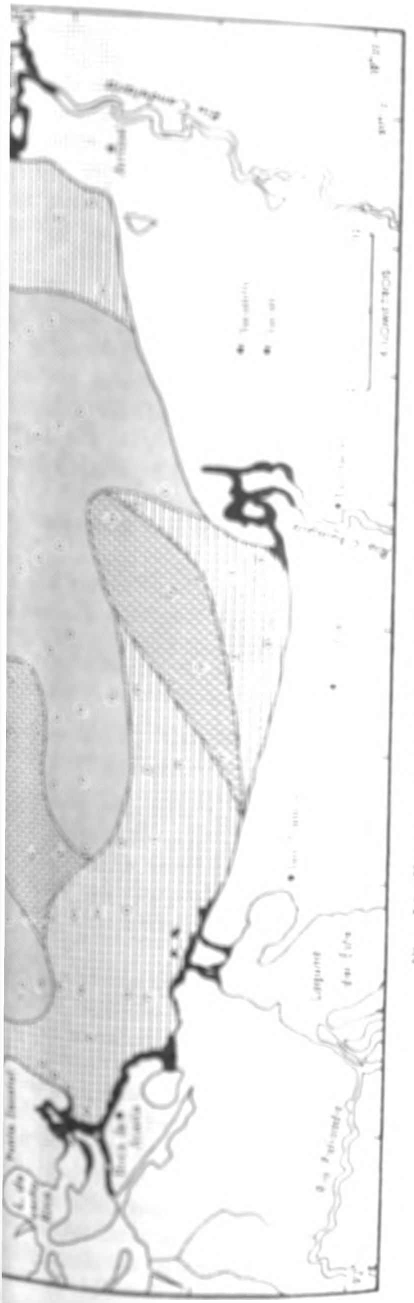

Fig. 12. Environments of deposition (After Yáñez, 1963).

SPECIES / STATIONS	3	5	6	7	8	10	14	16	30	31	32	34	36	37	38	39	41	42
Actinocythereis triangularis																		
Acuticythereis sp. A												3 / 8.1	1 / 50.0					
Acuticythereis sp. B																		
Aurila amygdala																		
Aurila floridana		★			★		10 / 18.5					13 / 35.1				4 / 18.1	4 / 20.0	
Bairdia bradyi																		
Basslerites minutus																		
Cyprideis castus																		
Cyprideis mexicana						★								★		★	★	
Cytherella aff. C. harpago															★			
Cytheromorpha paracastanea	1 / 25.0						1 / 1.8					★						
Cytherura elongata							19 / 35.1	★						3 / 33.3				
Cytherura aff. C. forulata																		
Cytherura radialirata				★								2 / 5.4			4 / 50.0	7 / 31.8	7 / 35.0	
Cytherura sandbergi	2 / 50.0									★		1 / 2.7		2 / 22.2	2 / 25.0	5 / 22.7	5 / 25.0	
Cytherura sp.																		
Cytherura swaini																		
Haplocytheridea bradyi												2 / 5.4						
Haplocytheridea setipunctata																		
Hemicytherura cranekeyensis																		
Hulingsina aff. H. rugipustulosa			★								★							
Leptocythere nikraveshae							1 / 1.8					2 / 5.4						
Loxoconcha matagordensis							1 / 1.8											
Loxoconcha purisubrhomboidea	1 / 25.0					★	1 / 1.8					4 / 10.8	1 / 50.0	2 / 22.2	★			
Loxoconcha aff. L. sarasotana																		
Megacythere johnsoni																	3 / 15.0	
Megacythere stephensoni							2 / 3.7											
Neocaudites nevianii												2 / 5.4						
Orionina bradyi																		
Paijenborchella (Neomonoceratina) mediterranea												2 / 5.4			2 / 25.0	3 / 13.6		
Pellucistoma magniventra												1 / 2.7						
Perissocytheridea bicelliforma																		
Perissocytheridea brachyforma	★									★				★	★	3 / 13.6	1 / 5.0	1 / 50.0
Perissocytheridea excavata																		
Perissocytheridea rugata							14 / 25.9					2 / 5.4						1 / 50.0
Paracytheridea vandenboldi																		
Pumilocytheridea ayalai												2 / 5.4						
Tanella gracilis							5 / 9.2					1 / 2.7		2 / 22.2				
Xestoleberis rigbyi									4 / 100				★					
TOTALS	4	★	★	★	★	★	54	★	4	★	★	37	2	9	8	22	20	2

SPECIES / STATIONS	44	45	46	47	48	49	52	53	54	55	57	58	60	61	62	63	64	68	69	70	71
Actinocythereis triangularis		★									2 / 5.0	15 / 6.8		1 / 16.6	2 / 16.6	6 / 21.4	4 / 4.6				
Acuticythereis sp. A		4 / 0.7																			
Acuticythereis sp. B									26 / 22.9												
Aurila amygdala																					
Aurila floridana	10 / 7.7	12 / 2.3			4 / 40.0							50 / 22.9			★	4 / 14.2	18 / 20.9	★			
Bairdia bradyi																					
Basslerites minutus		2 / 0.3																			
Cyprideis castus									2 / 1.7												
Cyprideis mexicana									★									3 / 13.6	★		★
Cytherella aff. C. harpago	★	1 / 0.1	★		★	★		★				18 / 8.2	★	★	★		4 / 4.6				
Cytheromorpha paracastanea	16 / 12.4	31 / 6.0	7 / 24.1		★							4 / 1.8	1 / 7.1	1 / 16.6			★				
Cytherura elongata	8 / 6.2	60 / 11.6	10 / 34.4									14 / 6.4		★		1 / 3.5	4 / 4.6	1 / 4.5			
Cytherura aff. C. forulata																					
Cytherura radialirata	2 / 1.5	16 / 3.1	1 / 3.4			6 / 40.0		★			1 / 2.5	2 / 0.9					2 / 2.3				
Cytherura sandbergi	4 / 3.1	44 / 8.5	2 / 6.9	1 / 100		5 / 33.3			17 / 15.0		1 / 2.5	17 / 7.7	2 / 14.2		1 / 8.3	3 / 10.7	2 / 2.3	9 / 40.9	1 / 50.0	2 / 100	
Cytherura sp.		2 / 0.3																			
Cytherura swaini		2 / 0.3																			
Haplocytheridea bradyi		9 / 1.7							2 / 1.7		10 / 25.0	14 / 6.4	1 / 7.1				2 / 2.3	4 / 18.1			
Haplocytheridea setipunctata												3 / 1.3			★						
Hemicytherura cranekeyensis					2 / 20.0																
Hulingsina aff. H. rugipustulosa			1 / 3.4																		
Leptocythere nikraveshae		2 / 0.3			2 / 20.0	2 / 13.3								2 / 33.3							
Loxoconcha matagordensis	1 / 0.7	2 / 0.3										1 / 0.4			2 / 16.6		6 / 6.9				
Loxoconcha purisubrhomboidea	63 / 48.8	190 / 36.8	3 / 10.3		2 / 20.0								★								
Loxoconcha aff. L. sarasotana																		2 / 9.0			
Megacythere johnsoni		4 / 0.7	1 / 3.4			2 / 13.3			2 / 1.7		1 / 2.5		1 / 7.1								
Megacythere stephensoni		8 / 1.5										6 / 2.7			1 / 8.3	2 / 7.1	2 / 2.3				
Neocaudites nevianii		2 / 0.3										2 / 0.9				6 / 21.4	4 / 4.6				
Orionina bradyi																					
Paijenborchella (Neomonoceratina) mediterranea	2 / 1.5	55 / 10.6	2 / 6.9									29 / 13.2									
Pellucistoma magniventra	★	5 / 0.9																			
Perissocytheridea bicelliforma									58 / 51.2												
Perissocytheridea brachyforma		7 / 1.3	★	★		★	1 / 100		4 / 3.5	★	23 / 57.5		1 / 7.1						1 / 50.0		★
Perissocytheridea excavata		4 / 0.7							2 / 1.7												
Perissocytheridea rugata	10 / 7.7	3 / 0.5									2 / 5.0	6 / 2.7	1 / 7.1	1 / 16.6	3 / 25.0	1 / 3.5	18 / 20.9	2 / 9.0			
Paracytheridea vandenboldi																					
Pumilocytheridea ayalai		8 / 1.5										3 / 1.3									
Tanella gracilis	1 / 0.7	31 / 6.0	2 / 6.9									30 / 13.7	7 / 50.0	1 / 16.6	2 / 16.6	5 / 17.8	20 / 23.2	1 / 4.5			
Xestoleberis rigbyi	2 / 1.5	12 / 2.3	★					2 / 100				18 / 8.2	★		1 / 8.3						
TOTALS	119	516	29	1	10	15	1	2	113	★	40	232	14	6	12	28	86	22	2	2	★

SPECIES / STATIONS	75	76	77	78	79	80	81	82	84	86	87	90	91	93	94	95	96	97	99
Actinocythereis triangularis				4 / 18.1	5 / 4.3	2 / 10.0					12 / 12.0	2 / 0.9	1 / 1.4	2 / 2.6				2 / 6.6	
Acuticythereis sp. A																			
Acuticythereis sp. B																			
Aurila amygdala																			
Aurila floridana		2 / 8.0	2 / 5.7	5 / 22.7	44 / 38.5	2 / 10.0	11 / 11.3		★		36 / 36.0	48 / 21.9	17 / 24.6	31 / 41.3	2 / 1.9		10 / 43.4	5 / 16.6	24 / 53.3
Bairdia bradyi																			
Basslerites minutus																			
Cyprideis castus																			
Cyprideis mexicana	★				1 / 0.8							2 / 0.9							
Cytherella aff. C. harpago											13 / 13.0	★	1 / 1.4	2 / 2.6		★		4 / 13.3	★
Cytheromorpha paracastanea							2 / 2.0		3 / 7.6		1 / 1.0	10 / 4.5	1 / 1.4	1 / 1.3	★		★		3 / 6.6
Cytherura elongata	2 / 16.6	6 / 24.0	12 / 34.2		7 / 6.1		8 / 8.2	1 / 7.1	10 / 25.6	★	3 / 3.0	16 / 7.3	5 / 7.2	7 / 9.3	16 / 15.8	4 / 23.5			1 / 2.2
Cytherura aff. C. forulata																			
Cytherura radialirata	2 / 16.6			2 / 9.0				2 / 14.2	1 / 2.5			2 / 0.9	3 / 4.3		2 / 1.9	2 / 11.7			
Cytherura sandbergi		1 / 4.0			4 / 3.5	1 / 5.0	2 / 2.0		1 / 2.5	★	14 / 14.0	12 / 5.5	7 / 10.1	3 / 4.0	6 / 5.9	8 / 47.0		4 / 13.3	
Cytherura sp.																			
Cytherura swaini																			
Haplocytheridea bradyi		1 / 4.0	1 / 2.8		1 / 0.8							4 / 1.8	1 / 1.4	2 / 2.6	2 / 1.9		1 / 4.3		3 / 6.6
Haplocytheridea setipunctata																		★	
Hemicytherura cranekeyensis																			
Hulingsina aff. H. rugipustulosa																			
Leptocythere nikraveshae							10 / 10.3					14 / 6.4	3 / 4.3		28 / 27.7				
Loxoconcha matagordensis					1 / 0.8		2 / 2.0		5 / 12.8	1 / 14.2	4 / 4.0	20 / 9.1	1 / 1.4	1 / 1.3	4 / 3.9			★	3 / 6.6
Loxoconcha purisubrhomboidea								★											
Loxoconcha aff. L. sarasotana					1 / 0.8														
Megacythere johnsoni		1 / 4.0		1 / 4.5				1 / 7.1						1 / 1.3					1 / 2.2
Megacythere stephensoni	2 / 16.6				1 / 0.8	1 / 5.0	4 / 4.1	4 / 28.5	6 / 15.3	1 / 14.2		6 / 2.7	7 / 10.1	9 / 12.0	15 / 14.8			1 / 3.3	
Neocaudites nevianii			4 / 11.4		2 / 1.7	2 / 10.0	4 / 4.1	2 / 14.2			2 / 2.0	6 / 2.7	6 / 8.6		2 / 1.9		2 / 8.6		
Orionina bradyi																			
Paijenborchella (Neomonoceratina) mediterranea																			
Pellucistoma magniventra									1 / 2.5	1 / 14.2		2 / 0.9	2 / 2.9	2 / 2.6	2 / 1.9				
Perissocytheridea bicelliforma																			
Perissocytheridea brachyforma	4 / 33.3	9 / 36.0								1 / 14.2		4 / 1.8			4 / 3.9	2 / 11.7		★	★
Perissocytheridea excavata																			
Perissocytheridea rugata	2 / 16.6	5 / 20.0	8 / 22.8	5 / 22.7	40 / 35.0	8 / 40.0	20 / 20.6	2 / 14.2	2 / 5.1		2 / 2.0	12 / 5.5	3 / 4.3	4 / 5.3	8 / 7.9			2 / 6.6	2 / 4.4
Paracytheridea vandenboldi																			
Pumilocytheridea ayalai					1 / 0.8						2 / 2.0	4 / 1.8			2 / 1.9				
Tanella gracilis			8 / 22.8	4 / 18.1	5 / 4.3	4 / 20.0	34 / 35.0	2 / 14.2	6 / 15.3	2 / 28.5	9 / 9.0	54 / 24.7	11 / 15.9	10 / 13.3	8 / 7.9	1 / 5.8	8 / 34.7	2 / 6.6	4 / 8.8
Xestoleberis rigbyi			★	1 / 4.5	1 / 0.8				4 / 10.2	1 / 14.2	2 / 2.0			★			2 / 8.6	10 / 33.3	4 / 8.8
TOTALS	12	25	35	22	114	20	97	14	39	7	100	218	69	75	101	17	23	30	45

SPECIES / STATIONS	100	101	102	103	107	108	109	110	111	112	113	114	115
Actinocythereis triangularis					4 / 3.0	3 / 3.6	4 / 5.8		2 / 3.8	2 / 6.0			
Acuticythereis sp. A													
Acuticythereis sp. B													
Aurila amygdala													
Aurila floridana		3 / 12.5	3 / 6.9		45 / 34.0	16 / 19.2	4 / 5.8	10 / 15.1	8 / 15.3				
Bairdia bradyi													
Basslerites minutus													
Cyprideis castus													
Cyprideis mexicana	★						★			2 / 6.0			★
Cytherella aff. C. harpago		★		★	10 / 7.5	14 / 16.8	★	3 / 4.5		1 / 3.0			
Cytheromorpha paracastanea		★		★	20 / 15.1	2 / 2.4	2 / 2.9	1 / 1.5	4 / 7.6	1 / 3.0			
Cytherura elongata		2 / 8.3	2 / 4.6	2 / 2.8	14 / 10.6	3 / 3.6	6 / 8.8	1 / 1.5		3 / 9.0			
Cytherura aff. C. forulata													
Cytherura radialirata		7 / 29.1	11 / 25.5	9 / 12.6		2 / 2.4					★	★	
Cytherura sandbergi	1 / 100	6 / 25.0	10 / 23.2	17 / 23.9	10 / 7.5	6 / 7.2	2 / 2.9	3 / 4.5	8 / 15.3				1 / 100
Cytherura sp.													
Cytherura swaini													
Haplocytheridea bradyi		1 / 4.1	1 / 2.3		3 / 2.2	2 / 2.4			3 / 5.7	3 / 9.0	2 / 100		
Haplocytheridea setipunctata													
Hemicytherura cranekeyensis			2 / 4.6										
Hulingsina aff. H. rugipustulosa													
Leptocythere nikraveshae								2 / 3.0	2 / 3.8	1 / 3.0			
Loxoconcha matagordensis				★		4 / 4.8	4 / 5.8	3 / 4.5	1 / 1.9				
Loxoconcha purisubrhomboidea		2 / 8.3											
Loxoconcha aff. L. sarasotana			3 / 6.9	1 / 1.4									
Megacythere johnsoni		2 / 8.3	2 / 4.6	6 / 8.4				1 / 1.5		2 / 6.0		2 / 50.0	
Megacythere stephensoni			3 / 6.9		2 / 1.5	1 / 1.2		16 / 24.2	2 / 3.8	3 / 9.0			
Neocaudites nevianii					2 / 1.5	4 / 4.8	4 / 5.8		6 / 11.5				
Orionina bradyi													
Paijenborchella (Neomonoceratina) mediterranea					★								
Pellucistoma magniventra							★			★			
Perissocytheridea bicelliforma													
Perissocytheridea brachyforma		1 / 4.1	★	2 / 2.8	2 / 1.5	2 / 2.4	2 / 2.9		2 / 3.8		★	2 / 50.0	★
Perissocytheridea excavata													
Perissocytheridea rugata					8 / 6.0	13 / 15.6	8 / 11.7	12 / 18.1	6 / 11.5	7 / 21.2			
Paracytheridea vandenboldi													
Pumilocytheridea ayalai			4 / 9.3										
Tanella gracilis			2 / 4.6		8 / 6.0	11 / 13.2	22 / 32.3	10 / 15.1	8 / 15.3	8 / 24.2			
Xestoleberis rigbyi				34 / 47.8	4 / 3.0			4 / 6.0					
TOTALS	1	24	43	71	132	83	58	66	52	33	2	4	1

Table 1. Occurrence of species. In each square the upper number represents the amount of single valves; the lower number represents the relative abundance, in percentage, of the species to the total population at that statio[n]

94	95	96	97	99	100	101	102	103	107	108	109	110	111	112	113	114	115	116	117	118	119	121	122	123	124	125	126	135	137	138	139	140	142	146	148	149	150	151	152	153	155	159	160	161	163	164	167	168	170	176	179	180	181	182	183	185	186	188	189	190	192	193	194	195
			2 6.6						4 3.0	3 3.6	4 5.8		2 3.8	2 6.0																						1 1.8				3 7.8	2 8.6							2 3.1																
																																				1 1.8																				2 100			86 34.0	31 46.2		4 14.8	29 38.6	1 2.7
2 1.9		10 43.4	5 16.6	24 53.3		3 12.5	3 6.9		45 34.0	16 19.2	4 5.8	10 15.1	8 15.3													1 100					3 8.8	17 26.1	5 14.2	★	★	3 5.4	★			1 2.6	1 4.3		5 62.5	79 78.2	★		2 10.5	21 32.8	89 71.7					18 78.2		★	5 31.2		4 1.5	2 2.9	★	3 11.1	2 2.6	2 5.5
																																																												2 2.9		3 11.1	6 8.0	
																																																											8 3.1					
					★						★			2 6.0			★	★	1 20.0	2 66.6								22 68.7	3 50.0		★		4 11.4		★					2 5.2	1 4.3	4 44.4	1 12.5		1 3.8			8 12.5			2 66.6	1 20.0	★	2 8.6	2 100		1 6.2		8 3.1		★	2 7.4		
	★		4 13.3	★		★		★	10 7.5	14 16.8	★	3 4.5		1 3.0												★																																		★		★		
★		★		3 6.6		★		★	20 15.1	2 2.4	2 2.9	1 1.5	4 7.6	1 3.0											1 33.3							★																																
16 15.8	4 23.5			1 2.2		2 8.3	2 4.6	2 2.8	14 10.6	3 3.6	6 8.8	1 1.5		3 9.0									★	2 66.6			3 21.4				4 11.7	3 4.6	7 20.0			13 23.6			9 18.3	6 15.7	1 4.3							3 4.6	24 19.3								1 6.2		16 6.3	4 5.9		2 7.4	9 12.0	17 47.2
																																												2 1.9																				
2 1.9	2 11.7					7 29.1	11 25.5	9 12.6		2 2.4					★	★											2 14.2			2 66.6						3 5.4	1 4.7		1 2.0	1 2.6		1 11.1					2 10.5	3 4.6																
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ndance, in percentage, of the species to the total population at that station. The stars represent localities where only molts (instars) were found.

mentation, 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 which 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‰.

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 water, (2) salinities of 38‰ and (3) bottom sediment composed of sand and silty sand.

Aurila floridana Benson and Coleman tends to be concentrated in terrains whose sediments have a calcium carbonate content of 30-50 percent; it is not known from areas where the sediment consists of less than 20 percent calcium carbonate. For the most part it seems to avoid areas of fine mud and areas affected by the inflow of rivers. *A. floridana* is found indiscriminately throughout sandy areas where salinities range from 25 to 39‰. It is unknown from terrains of clayey silt, silty clay, and sandy silt, and seems to show a slight preference for clear water.

Bairdia bradyi van den Bold is restricted to the sandy areas of the washover tidal delta of Boca de Paso Real where the sediment has a calcium carbonate content of 60 to 70 percent. It prefers clear water with bottom salinities near 38‰.

Bassleriles minutus van den Bold is known from only two localities, having dissimilar ecologic settings. Station 189 at Boca de Paso Real is in the area of a sandy sediment composed of 50 to 60 percent calcium carbonate. The water is clear and the bottom salinity is about 38‰. Station 45 in the western lagoonal interior is situated in turbid waters, in the area of a sediment with a 40 to 50 percent calcium carbonate 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 calcium carbonate content and the bottom water has a salinity of 18‰.

Cyprideis mexicana Sandberg is found mostly in the clear water in the eastern portion of the lagoon. It seems to favor areas where the sediments have a calcium carbonate content of 20 to 30 percent; it declines in abundance as the calcium carbonate content decreases and is lacking in areas with sediments containing 10 to 20 percent calcium carbonate. *C. mexicana* is known mostly from areas of uniform deposition, being absent from areas of rapid deposition. It occurs in sand and clay but is scarce in silty terrains and is most common in areas with water salinities of 25 to 30‰. This species has been found throughout the lagoon and does not seem to show a preference for any particular depth.

Cytherella sp. aff. *C. harpago* Kornicker is found mostly in terrains where the calcium carbonate content of the sediments is 40 to 50 percent. Although it occurs in both clear and turbid water, the greatest concentration of specimens is found in clear water, 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 sand and silt but is unknown in the present study from areas of clay deposition. It is retricted to water with bottom salinities varying from 27 to 30‰.

Cytheromorpha paracastanea (Swain) is restricted to water with salinities of 27 to 34‰ and to sand and silt. It is very rare in the areas influenced by river water 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.

Cytherura elongata Edwards does not seem to have a strong preference for sedimentary areas of a particular calcium carbonate content, it tends to be more abundant where the carbonate content exceeds 30 percent, it is completely absent in areas with a calcium carbonate content of less than 20 percent. 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‰.

Cytherura radialirata Swain is an euryvalent form which occurs mainly in areas with sediments varying in calcium carbonate between 20 and 50 percent; it is absent from areas with 10 to 20 percent. It does not seem to be restricted to any environment of deposition or sediment type and the salinity ranges from 23 to 38‰. Turbidity does not have any noticeable effect on the distribution of this species.

Cytherura sandbergi sp. nov. is an euryvalent species whose distribution does not seem to be restricted by either the calcium carbonate content in the sediments or the salinity, depth, grain size, or turbidity of the water.

Haplocytheridea bradyi (Stephenson) apparently is not affected by calcium carbonate 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 percent calcium carbonate; it decreases in abundance away from the highly calcareous areas and is absent in areas of less than 20 percent calcium carbonate 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 water. It is found almost exclusively in sand at water depths of two fathoms in the center of the lagoon and in Boca de Paso Real and in salinities ranging from 29 to 38‰.

Hemicytherura cranekeyensis Puri is found in two completely different ecologic settings. One occurrence is in clear water 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 in the western portion of the lagoon, is in turbid water with lower salinities (stations 48 and 102). This form does not occur in areas of uniform or rapid deposition, but it does occur in sand and silt. It is not known at present from the depositional areas of clay.

Leptochythere nikraveshae sp. nov. occurs predominantly in areas where the sediments contain 40 to 50 percent calcium carbonate. It decreases in abundance proportionately in the areas of 40 to 20 percent sedimentary calcium carbonate and is absent from areas in wich the sediment contains less than 20 percent and more than 50 percent calcium carbonate. *L. nikraveshae* is found mostly in turbid water 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 an in areas containing sand and silt. 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 percent calcium carbonate, being particularly abundant in the 30 to 40 percent range and unknown where the calcareous content is less than 20 percent. Although it occurs in both clear and turbid water, it shows a marked preference for clear water and tends to be concentrated in the eastern portion of the lagoon, particularly at depths of two fathoms where bottom-water salinities vary between 28 and 39‰. It is present mainly in the sand 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 areas affected by the rivers.

Loxoconcha purisubrhomboidea Edwards possesses a marked preference for the turbid water in the western portion of the lagoon. It is found mostly in areas of 40 to 50 percent sedimentary calcium carbonate, being rare in the areas of 20 to 30 percent calcareous matter, and unknown where the calcium carbonate content of the sediments is below 20 percent. This form occurs where water salinities exceed 28‰. It tends to be concentrated in the vicinity of both passes at depths of one to two fathoms. It is present in areas of sand and silt 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 sp. aff. *L. sarasotana* Benson and Coleman is found in areas varying from 20 to 40 percent sedimentary calcium carbonate. It is absent or unknown from areas with higher and lower percentages of calcareous matter. It is found mostly in the zone of turbid water, appears to be restricted to a salinity of 27 to 29‰ 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 turbidity of the water, calcium carbonate content of the sediments, bottom salinity, grain size, or environment of deposition. It is found at all depths, although 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 calcium carbonate of 30 to 50 percent; it is apparently absent from sediments with less than 20 percent calcareous material. It is found in both clear and turbid water and although the greatest number of stations containing this form are in the zone of clear water, the greatest number of specimens occurs in turbid water. This species is present in all depths of the lagoon, in salinities varying from

26 to 39‰ 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 sand and silt and is rare in the depositional areas of clay.

Neocaudites nevianii Puri is known mainly in areas with a sedimentary calcium carbonate content higher than 30 percent; in areas with salinities varying between 28 and 39‰, being particularly abundant in the 38 to 39‰ 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 sand and silt, 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 stations 189 and 190 in Boca de Paso Real, an area of clear water and sandy bottom with a sedimentary calcium carbonate content of 50 to 70 percent and a salinity of 38‰.

Although *Paijenborchella* (*Neomonoceratina*) *mediterranea* Ruggieri does not exhibit a marked preference for sedimentary areas with a particular amount of calcium carbonate, it is absent from areas where the calcareous content is less than 20 percent. Stations from which the highest number of specimens have been obtained to date are situated in areas of 40 to 50 percent sedimentary calcium carbonate. This species is widely distributed in most depositional environments in the lagoon; it is abundant in sand and it is absent or unknown in areas of clay deposition.

Pellucistoma magniventra Edwards is a species which prefers areas with a sedimentary calcium carbonate content between 20 and 60 percent. It occurs in both clear and turbid water without apparent preference, in salinities of 26 to 38‰ and in sand and silt. 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‰. The bottom sediment is sandy and consists of 10 to 20 percent calcium carbonate.

Perissocytheridea brachyforma Swain is an euryvalent species; it does not reflect marked effect by turbidity of the water, calcium carbonate content of the sediments, environment of deposition, grain size, or sediment type.

Perissocytheridea excavata Swain has been recorded from only four stations; it occurs in areas with sediments having a 10 to 50 percent calcium carbonate content and water with salinities ranging from 18 to 30‰. There appears to be a marked preference for salinities lower than 26‰ and for areas less than one fathom deep. Grain size does not seem to affect the distribution of this species; it is found predominantly in sandy areas except for the washover delta in the vicinity of Boca de Paso Real.

Perissocytheridea rugata Swain is found in areas with a sedimentary calcium carbonate content of 10 to 70 percent; it is concentrated mostly in areas with 30 to 50 percent of calcareous matter. This species occurs in both clear and turbid water but exhibits a marked preference for clear water. It is present throughout the lagoon in depths ranging from less than a fathoms 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‰. Most specimens occur in water with salinities of 28 to 31‰. 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 ayalai sp. nov. is restricted to sediments with a content of 20 to 50 percent calcium carbonate, but is most abundant in the 40 to 50 percent 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 sand and silt but is absent or unknown in areas of clay deposition.

Tanella gracilis Kingma lives in areas where the sediments have a calcium carbonate content of 20 to 70 percent, but seems to prefer areas with calcareous content between 40 and 50 percent. Although more stations containing this species occur in clear water, the stations with the greatest number of specimens are in turbid water near the contact with clear water. This species is found at depths ranging 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‰ being most abundant in the areas with 28 to 31‰. Although it is found in all sediment types, it is less common in areas of sand deposition.

The distribution of *Xestoleberis rigbyi* sp. nov. does not appear to be controlled primarily by the calcium carbonate content as it is found in areas where the sediments are 10 to 70 percent calcareous matter. It occurs in zones of turbid and clear water 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‰, it is most abundant in areas with salinities above 27‰. It is widely distributed throughout the lagoon, being most abundant in sandy areas and unkonwn in areas of clay deposition.

SYSTEMATICS

Subclass OSTRACODA Latreille, 1806
Order PODOCOPIDA Müller, 1894
Suborder PODOCOPINA Sars, 1866
Superfamily BAIRDIACEA 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., v. 1, p. 56, pl. 7, figs. 4-6.
Brady, 1880, Rept. Voy. "Challenger," Zool., v. 1, pt. 3, p. 55, pl. 8, figs. 1a-f, 2a-f.
? *Bairdia foveolata* Brady. Chapman and Crespin, 1928, Victoria Geol. Survey, Rec., v. 5, p. 169.
Not *Bairdia foveolata* Bosquet, 1852, Acad. Roy. Sci. Lett. Belgique, Mém. Cour., v. 24, p. 21, pl. 1, figs. 5a-d.
Not *Bairdia faveolata* Egger, 1901, K. Bayer Akad. Wiss. München, Math. Phys. Cl., abh., v. 21, pt., 2, p. 426, pl. 2, figs. 1-4.
Bairdia bradyi van den Bold, 1957, Micropalentology, v. 3, n. 3, p. 236, pl. 1, fig. 5.
Puri, 1960, Trans., Gulf Coast Assoc. Geol. Soc., v. 10, p. 130.
Bairdia cf. *B. bradyi* van den Bold. Benson and Coleman, 1963, Univ. Kansas, Paleont. Contr., Arthropoda, art. 2, p. 18, pl. 2, figs. 1-3, text-fig. 7.

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

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

OCCURRENCE: 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. It was reported from New Providence in 1870, from Bermuda in 1880, from the Miocene of Trinidad and from the Recent of the Gulf of Mexico off the Florida coast.

REMARKS: The specimens from Laguna de Términos were compared with material collected by Pedro J. Bermudez from the northern coast of Cuba; the forms are identical except that the Cuban forms are larger.

Bairdia bradyi differs from *Bairdopilata triangulata* Edwards (1944) 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; unfigured specimens H. V. H. 8118-8119.

* IGM 2670-2673 Mi: Instituto de Geología, Universidad Nacional Autónoma de México, micropaleontology collection. H. V. H. 8118-8119: Henry V. Howe Collection, Louisiana State University.

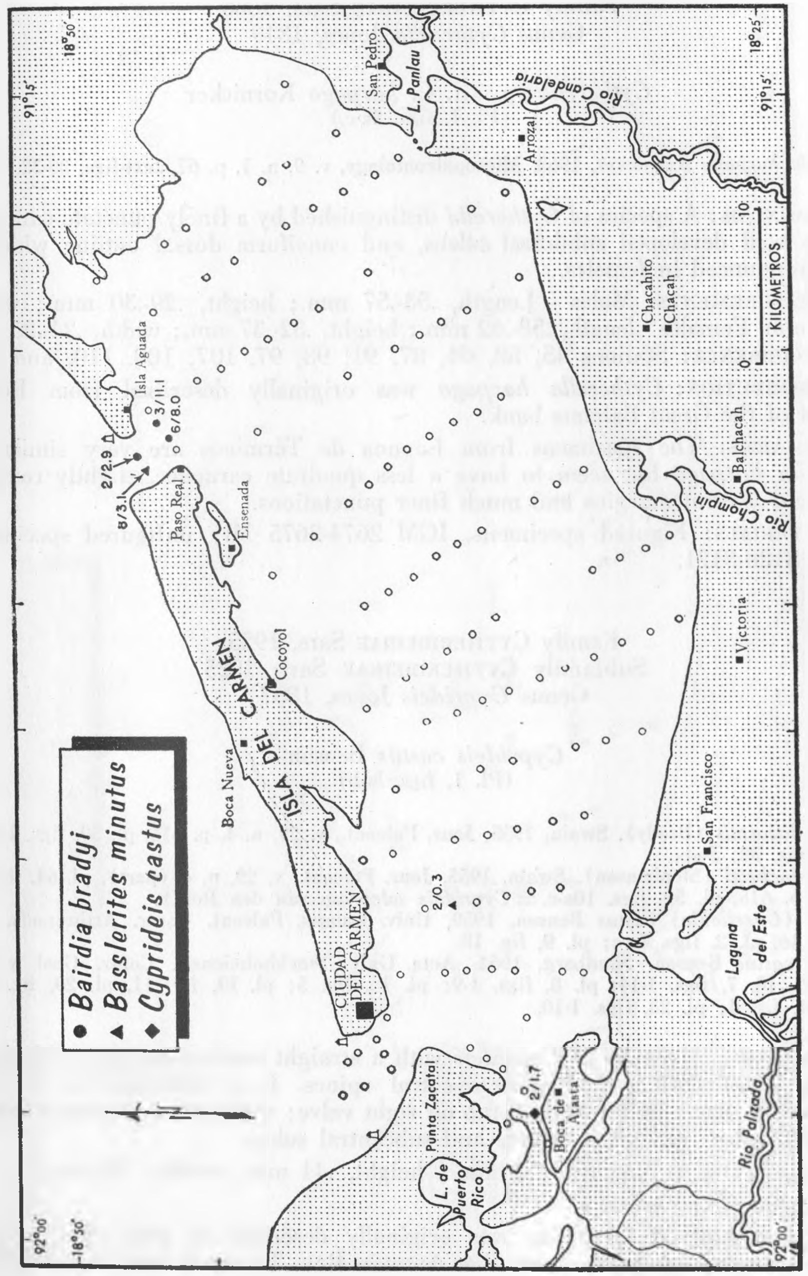

Fig. 13. Distribution of *Bairdia bradyi*, *Basslerites minutus*, and *Cyprideis castus*.

Family CYTHERELLIDAE Sars, 1866
Genus *Cytherella* Jones, 1849

Cytherella sp. aff. *C. harpago* Kornicker
(Pl. 1, figs. 2a-c.)

Cytherella harpago Kornicker, 1963, Micropaleontology, v. 9, n. 1, p. 67, text-figs. 30-32, 39-42.

DIAGNOSIS: A species of *Cytherella* distinguished by a finely punctate carapace, faint to well developed subdorsal sulcus, and cuneiform dorsal outline which is more 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: Stations 45, 58, 64, 87, 91, 93, 97, 107, 108, 110, and 112.

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

REMARKS: The specimens from Laguna de Términos are very similar to *Cytherella harpago* but seem to have a less quadrate carapace, slightly rounded dorsal and ventral margins and much finer punctations.

MATERIALS: Figured specimens, IGM 2674-2675 Mi; unfigured specimens, H.V.H. 8120-8121.

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. Paleont., v. 29, n. 4, p. 615, pl. 59, figs. 11a-c; text-figs. 38: 5a-b.
Cyprideis locketti (Stephenson). Swain, 1955, Jour. Paleont., v. 29, n. 4 (part), pl. 64. fig. 13 (not p. 615, pl. 59, figs. 10a-c. = *Cyprideis salebrosa* van den Bold).
Cyprideis (Goerlichia) castus Benson, 1959, Univ. Kansas, Paleont. Contr. Arthropoda, art. 1, p. 46, pl. 2, figs. 4a-c; pl. 9, fig. 10.
Cyprideis castus Benson. Sandberg, 1964, Acta Univ. Stockholmiensis, Contr. Geol. v. 12, p. 102, pl. 7, figs. 1-14; pl. 8, figs. 1-9; pl. 16, fig. 5; pl. 19, fig. 11, pl. 20, fig. 12; pl. 21, fig. 4; pl. 23, 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: Station 54.

DISTRIBUTION: This species was originally described in 1955 as *Cyprideis littoralis* (Brady) by Swain from San Antonio Bay, Texas; it has been reported

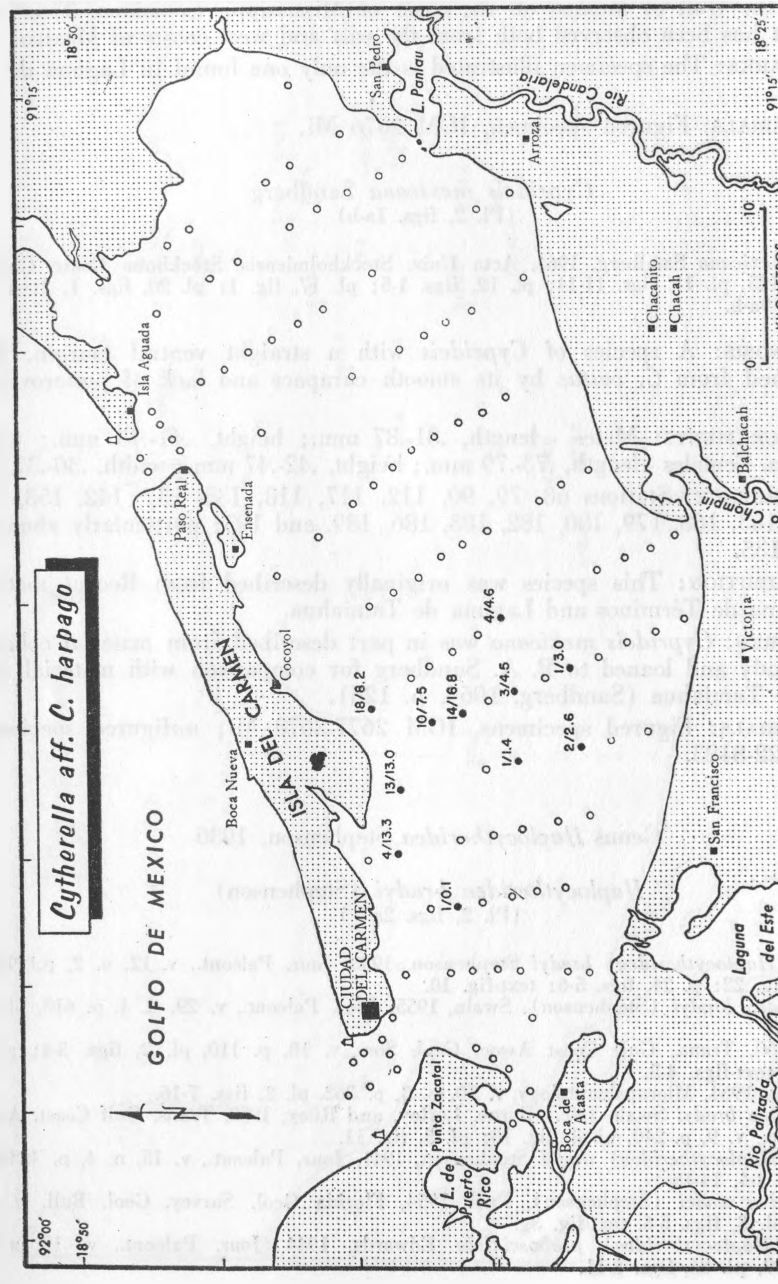

Fig. 14. Distribution of *Cytherella* sp. aff. *C. harpago*.

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 Términos.

MATERIALS: Figured specimen, IGM 2676 Mi.

Cyprideis mexicana Sandberg
(Pl. 2, figs. 1a-b)

Cyprideis mexicana Sandberg, 1964, Acta Univ. Stockholmiensis, Stockholm Contr. Geol., v. 12, p. 125, pl. 11, figs. 11-14; pl. 12, figs. 1-5; pl. 17, fig. 1; pl. 20, figs. 1, 2; pl. 22, figs. 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: Stations 68, 79, 90, 112, 117, 118, 135, 137, 142, 153, 155, 159, 160, 163, 168, 179, 180, 182, 183, 186, 189, and 193; particularly abundant at station 135.

DISTRIBUTION: This species was originally described from Recent material from Laguna de Términos and Laguna de Tamiahua.

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 (Sandberg, 1964, p. 126).

MATERIALS: Figured specimens, IGM 2677-2678 Mi; unfigured specimens, H.V.H. 8122-8123.

Genus *Haplocytheridea* Stephenson, 1936

Haplocytheridea bradyi (Stephenson)
(Pl. 2, figs. 2a-b.)

Cytheridea (Haplocytheridea) bradyi Stephenson, 1938, Jour. Paleont., v. 12, n. 2, p.129-132, pl. 23, fig. 22; p. 24, figs. 5-6; text-fig. 10.
Haplocytheridea bradyi (Stephenson). Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 618, pl. 59, fig. 12a-b.
Puri, 1960, Trans.. Gulf Coast Assoc. Geol. Soc., v. 10, p. 110, pl. 2, figs. 3-4; pl. 6, fig. 19: text-figs. 4-5.
Sandberg, 1964, Micropaleontology, v. 10, n. 3, p. 362, pl. 2, figs. 7-16.
Haplocytheridea bradyi Swain [*sic.*] Byrne, LeRoy, and Riley, 1959, Trans. Gulf Coast. Assoc. Geol. Soc., v. 9, p. 240, pl. 4, fig. 10; pl. 5, fig. 11.
Cytheridea (Haplocytheridea) wadei Stephenson, 1941, Jour. Paleont., v. 15, n. 4, p. 428-429, text-figs. 3-4, 14-18.
Haplocytheridea wadei (Stephenson). Puri, 1954, Florida Geol. Survey, Geol. Bull. n. 36, p. 231, pl. 3, figs. 5-6, text-fig. 3g.
Cytheridea (Haplocytheridea) proboscidiala Edwards, 1944, Jour. Paleont., v. 18, n. 6, p. 508-509, pl. 85, figs. 8-11.

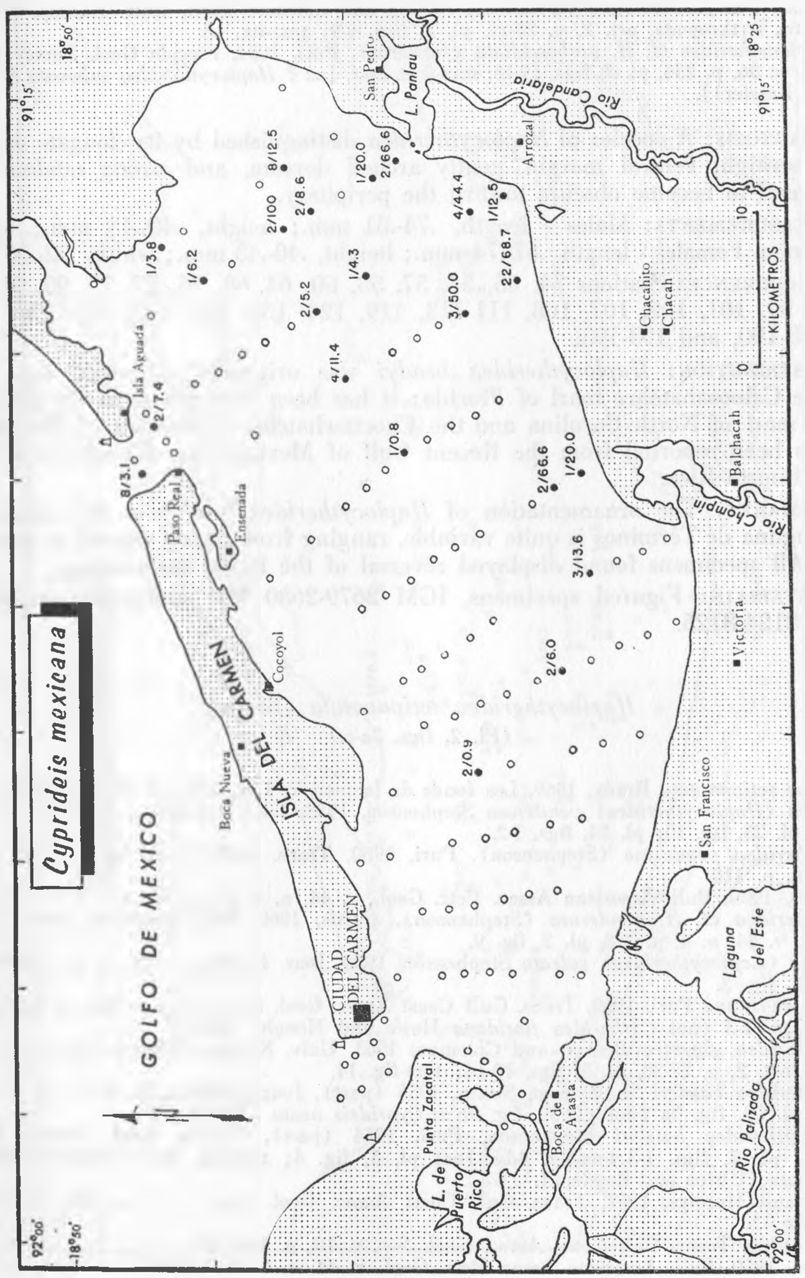

Fig. 15. Distribution of *Cyprideis mexicana*.

Haplocytheridea proboscidiala (Edwards). Benson and Coleman, 1963, Univ. Kansas, Paleont. Contr., Arthropoda, art. 2, p. 28-29, pl. 3, figs. 4-9; text-fig. 15.
Not *Haplocytheridea* cf. *H. proboscidiala* (Edwards). Puri, 1954, Florida Geol. Survey, Geol. Bull. n. 36, p. 234, pl. 2, figs. 17-18, text-figs. 3e-f. [= ? *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: Stations 34, 45, 54, 57, 58, 60, 64, 68, 76, 77, 79, 90, 91, 93, 94, 96, 99, 101, 102, 107, 108, 111-113, 119, 124, 135, 138, 142, 149, 158, 159, 168, 188-190, and 193-195.

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 *Haplocytheridea bradyi* in the specimens from Laguna de Términos 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; unfigured specimens, H.V.H. 8124-8125.

Haplocytheridea setipunctata (Brady)

(Pl. 2, figs. 3a-c.)

Cytheridea setipunctata Brady, 1869, Les fonds de la mer, v. 1, p. 124, pl. 14, figs. 15-16.
Cytheridea (*Haplocytheridea*) *ponderosa* Stephenson, 1938, Jour. Paleont., v. 12, n. 2, p. 133-134, pl. 23, fig. 10; pl. 24, figs. 1-2.
Haplocytheridea ponderosa (Stephenson). Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 110.
Curtis, 1960, Bull. American Assoc. Petr. Geol., v. 44, n. 4, pl. 3, fig. 1.
Haplocytheridea cf. *H. ponderosa* (Stephenson). Curtis, 1960, Bull. American Assoc. Petr. Geol., v. 44, n. 4, p. 478, pl. 2, fig. 9.
Cytheridea (*Leptocytheridea*) *sulcata* Stephenson, 1938, Jour. Paleont., v. 12, n. 2, p. 139-140, pl. 23, fig. 2.
Cyprideis floridana Puri, 1960, Trans. Gulf Coast Assoc. Geol, Soc., v. 10, p. 100, pl. 2, fig. 5; text-figs. 1-3 (not *Cytheridea floridana* Howe and Hough, 1935).
Haplocytheridea gigantea Benson and Coleman, 1963, Univ. Kansas, Paleont. Contr., Arthropoda, art. 2, p. 27-28, pl. 3, figs. 10-14; text-fig. 14.
Haplocytheridea bassleri Stephenson. Swain, 1955 (part), Jour. Paleont., v. 29, n. 4, p. 617-618, pl. 59, fig. 9a [not pl. 59, fig. 9b = *Cyprideis ovata* (Mincher)].
? *Haplocytheridea bassleri* Stephenson. Puri, 1954 (part), Florida Geol. Survey, Bull. n. 36, pl. 3, figs. 1-3; text-fig. 4d-e [not pl. 3, fig. 4; text-fig. 4c-f. = *Haplocytheridea subovata* (Ulrich and Bassler)].
Puri and Hulings, 1957, Trans. Gulf Coast Assoc. Geol. Soc., v. 7. p. 176, 183, 188; text-fig 11.
Puri, 1960. Trans. Gulf Coast Assoc. Geol. Soc. v. 10, p. 108-110.
Curtis. 1960, Bull. American Assoc. Petr. Geol., v. 44, n. 4, pl. 3, fig. 2.

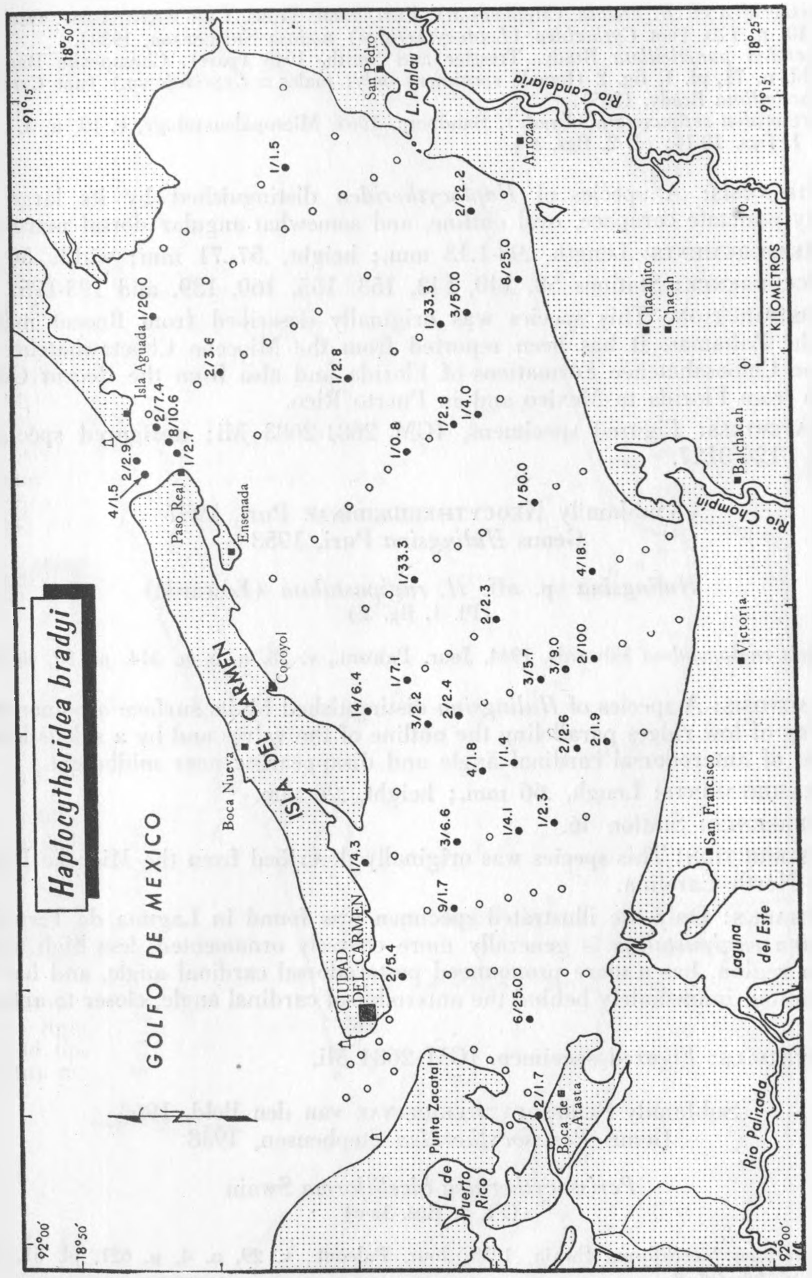

Fig. 16. Distribution of *Haplocytheridea bradyi*.

Haplocytheridea cf. *H. nodosa* (Stephenson). Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 110. [not *Cytheridea* (*Leptocytheridea*) *nodosa* Stephenson, 1938].
? *Cytheridea puncticillata* Brady. Tressler and Smith, 1948 (part), Chesapeake Biol. Lab. Publ. n. 71, pl. 1, fig. 2 (female specimens only; males = *Cyprideis* sp.) (not *Cytheridea puncticillata* Brady, 1865).
Haplocytheridea setipunctata (Brady). Sandberg, 1964, Micropaleontology, v. 10, n. 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: Stations 58, 140, 142, 153, 155, 160, 189, and 193-195.

DISTRIBUTION: This species was originally described from Recent material from the Bahamas. It has been reported from the Miocene Choctawhatchee and Pliocene Caloosahatchee Formations of Florida and also from the Recent Gulf of Mexico from Florida to Mexico and in Puerto Rico.

MATERIALS: Figured specimens, IGM 2681-2683 Mi; unfigured specimens, H.V.H. 8126-8127.

Subfamily NEOCYTHERIDEIDINAE Puri, 1957
Genus *Hulingsina* Puri, 1958

Hulingsina sp. aff. *H. rugipustulosa* (Edwards)
(Pl. 1, fig. 3.)

Cytherideis rugipustulosa Edwards, 1944, Jour. Paleont., v. 18, n. 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: Lengh, .66 mm.; height, .26 mm.

OCURRENCE: Station 46.

DISTRIBUTION: This species was originally described from the Miocene Duplin marl of North Carolina.

REMARKS: Only the illustrated specimen was found in Laguna de Términos. *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.

Subfamily PERISSOCYTHERIDEINAE van den Bold, 1963
Genus *Perissocytheridea* Stephenson, 1938

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

Perissocytheridea bicelliforma Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 621, pl. 51, figs. 3a-b; pl. 64. fig. 4.

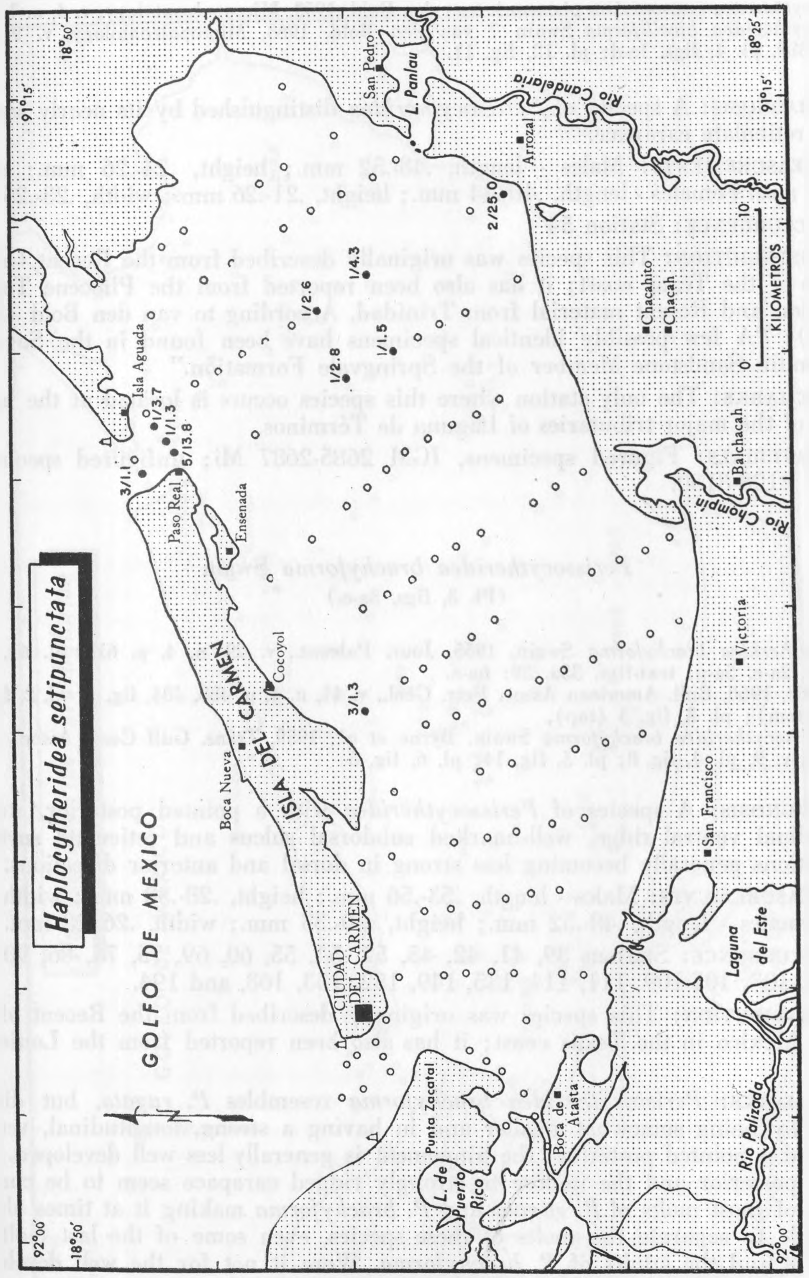

Fig. 17. Distribution of *Haplocytheridea setipunctata*.

Perissocytheridea matsoni (Stephenson). van den Bold ,1958, Micropaleontology, v. 4, n. 1, p. 71.
Perissocytheridea bicelliforma Swain ? van den Bold, 1963, Micropaleontology, v. 9, n. 4, p. 380, pl. 4, figs. 1a-d; pl. 12, fig. 11.

DIAGNOSIS: A species of *Perissocytheridea* distinguished by its nearly 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: 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 Savaneta Glauconitic 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 Términos.

MATERIALS: Figured specimens, IGM 2685-2687 Mi; unfigured specimens, H.V.H. 8128-8130.

Perissocytheridea brachyforma Swain
(Pl. 3, figs. 3a-e.)

Perissocytheridea brachyforma Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 619, pl. 61, figs. 1a-e, 2a-e, 5a-g; text-figs. 33a, 39: 6a-c.
Curtis, 1960, Bull. American Assoc. Petr. Geol., v. 44, n. 4, p. 483, 484, fig. 5; pl. 2, fig. 10 (bottom); pl. 3, fig. 3 (top).
Not *Perissocytheridea brachyforma* Swain. Byrne *et al.*, 1959, Trans. Gulf Coast Assoc., Geol. Soc., v. 9, pl. 4, fig. 8; pl. 5, fig. 14; pl. 6, fig. 5.

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, .53-.56 mm.; height, .28-.30 mm.; width, .29 mm. Females - length, .48-.52 mm.; height, .30-.33 mm.; width, .26-.28 mm.

OCCURRENCE: Stations 39, 41, 42, 45, 52, 54, 55, 60, 69, 75, 76, 86, 90, 94, 95, 101, 103, 107-109, 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 and in 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 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

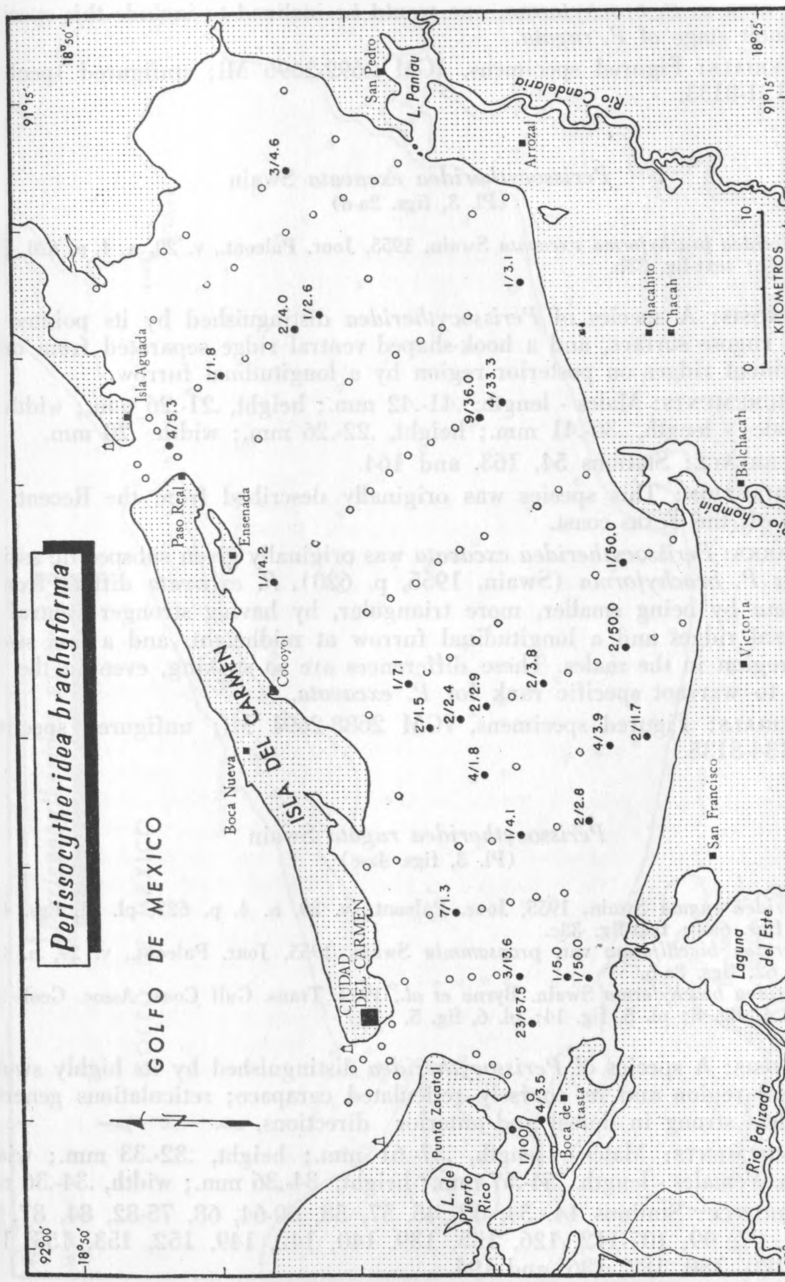

Fig. 18. Distribution of *Perissocytheridea brachyforma*.

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; unfigured specimens, H.V.H 8131-8133.

Perissocytheridea excavata Swain
(Pl. 3, figs. 2a-d)

Perissocytheridea brachyforma excavata Swain, 1955, Jour. Paleont., v. 29, n. 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, .21-.26 mm.; width, .22 mm. Females - length, .36-.41 mm.; height, .22-.26 mm.; width, .20 mm.

OCCURRENCE: Stations 54, 163, and 164.

DISTRIBUTION: This species was originally described from the Recent Gulf of Mexico off 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 midheight, and a less swollen posterior region in the males. These differences are so striking, even in the molt stages, as to warrant specific rank for *P. excavata*.

MATERIALS: Figured specimens. IGM 2688-2691 Mi; unfigured specimens H.V.H. 8134-8135.

Perissocytheridea rugata Swain
(Pl. 3, figs. 4a-e)

Perissocytheridea rugata Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 622, pl. 61, figs. 4a-b; pl. 62, figs. 6a-b; text-fig. 33c.
Perissocytheridea bicelliforma var. *propsammia* Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 622, pl. 62, figs. 8a-b.
Perissocytheridea brachyforma Swain. Byrne *et al.*, 1959, Trans. Gulf Coast Assoc. Geol. Soc., v. 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: Stations 14, 34, 42, 45, 57, 58, 60-64, 68, 75-82, 84, 87, 90, 91, 93, 94, 97, 99, 107-112, 126, 135, 139, 140, 142, 149, 152, 153, 155, 159, 167, 168, 170, 180, 182, 186, and 194.

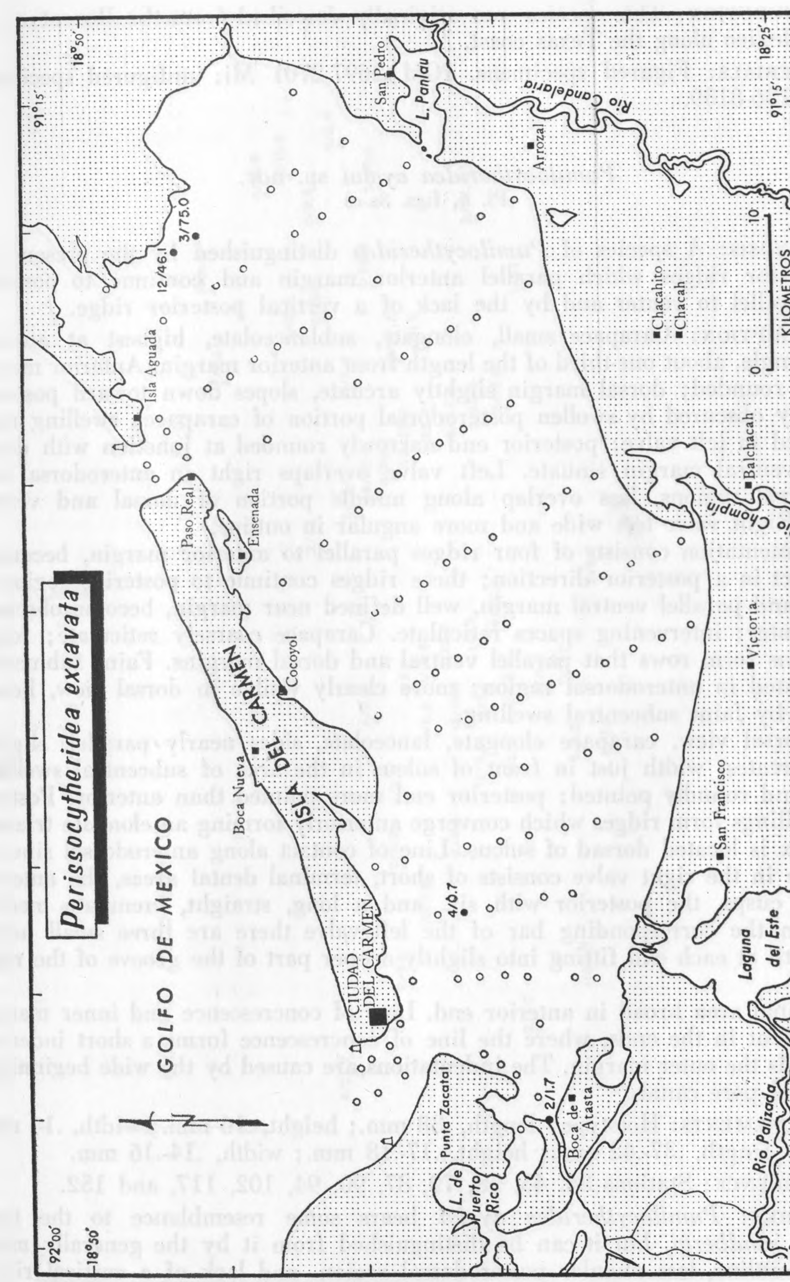

Fig. 19. Distribution of *Perissocytheridea excavata*.

DISTRIBUTION: This species was originally described from the Recent of the Gulf of Mexico along the Texas coast.

MATERIALS: Figured specimens, IGM 2697-2701 Mi; unfigured specimens, H.V.H. 8136-8139.

Pumilocytheridea ayalai sp. nov.
(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 region; 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 anterodorsal 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.

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

OCCURRENCE: Stations 34, 45, 58, 79, 87, 90, 94, 102, 117, and 152.

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 lack of a vertical ridge

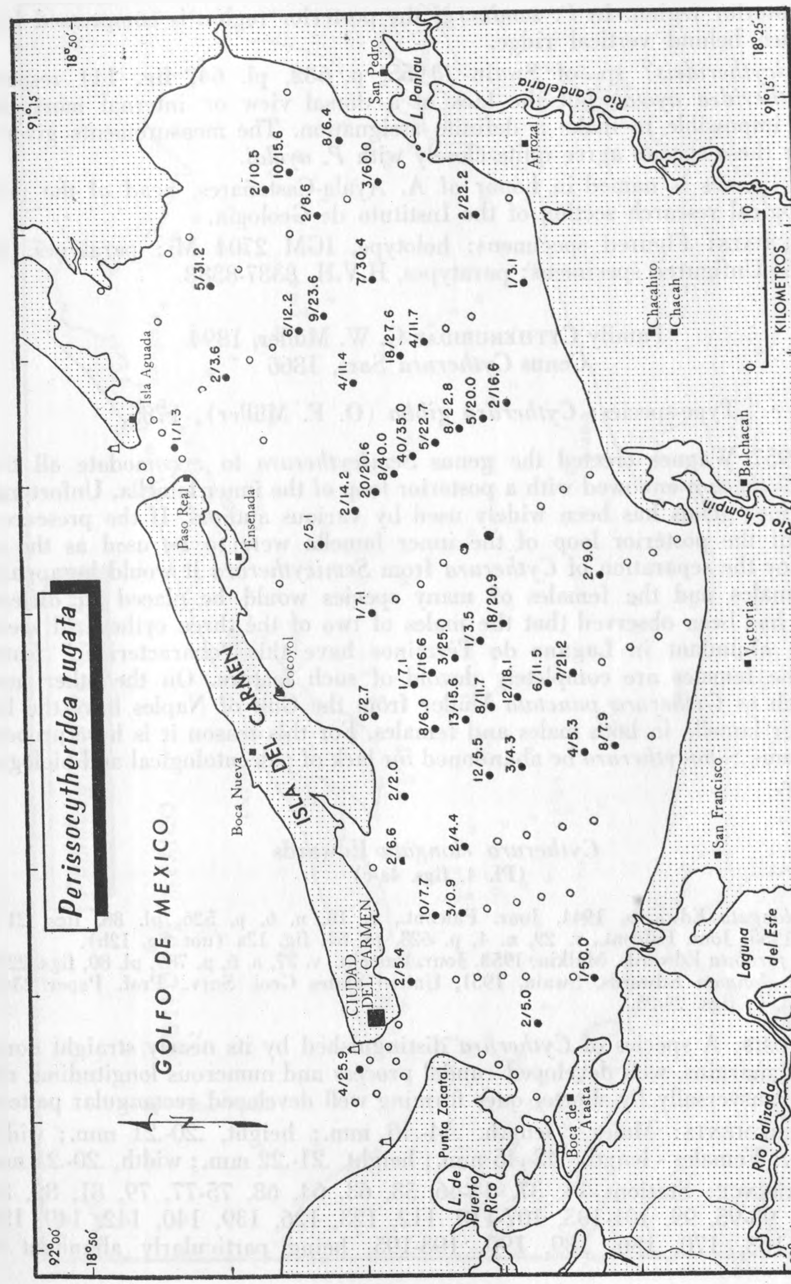

Fig. 20. Distribution of *Perissocytheridea rugata*.

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 A. Ayala-Castañares, head of the micropaleontological research section of the Instituto de Geología.

MATERIALS: Figured specimens: holotype, IGM 2704 Mi; paratypes, IGM 2705-2706. Unfigured specimens: paratypes, H.V.H. 8387-8388.

Family CYTHERURIDAE G. W. Müller, 1894
Genus *Cytherura* Sars, 1866

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

In 1957 Wagner erected the genus *Semicytherura* to accomodate all those forms of *Cytherura* endowed with a posterior loop of the inner lamella. Unfortunately the former genus has been widely used by various authors. If the presence or abscence 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. It has been observed that the males of two of the three cytherurid species which are abundant in Laguna de Términos have this "characteristic" feature whereas the females are completely devoid of such feature. On the other hand, species such as *Cytherura punctata* Müller from the Gulf of Naples have 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)

Cytherura elongata Edwards, 1944, Jour. Paleont., v. 18, n. 6, p. 526, pl. 88, figs. 21-25. Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 628, pl. 64, fig. 12a (not fig. 12b).
? *Cytherura forulata* Edwards. Malkin, 1953, Jour. Paleont., v. 27, n. 6, p. 789, pl. 80, figs. 22-24.
? *Cytherura elongata* Edwards. Swain, 1951, United States Geol. Surv., Prof. Paper 234-A, p. 50, pl. 7, figs. 24-25.

DIAGNOSIS: A species of *Cytherura* distinguished by its nearly straight dorsal and ventral margins, well developed caudal process and 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: Stations 14, 37, 44-46, 58, 63, 64, 68, 75-77, 79, 81, 82, 84, 87, 90, 91, 93-95, 99, 101-103, 107-110, 112, 123, 126, 139, 140, 142, 149, 152, 153, 155, 168, 170, 186, 189, 190, 193-195, being particularly abundant in station 45.

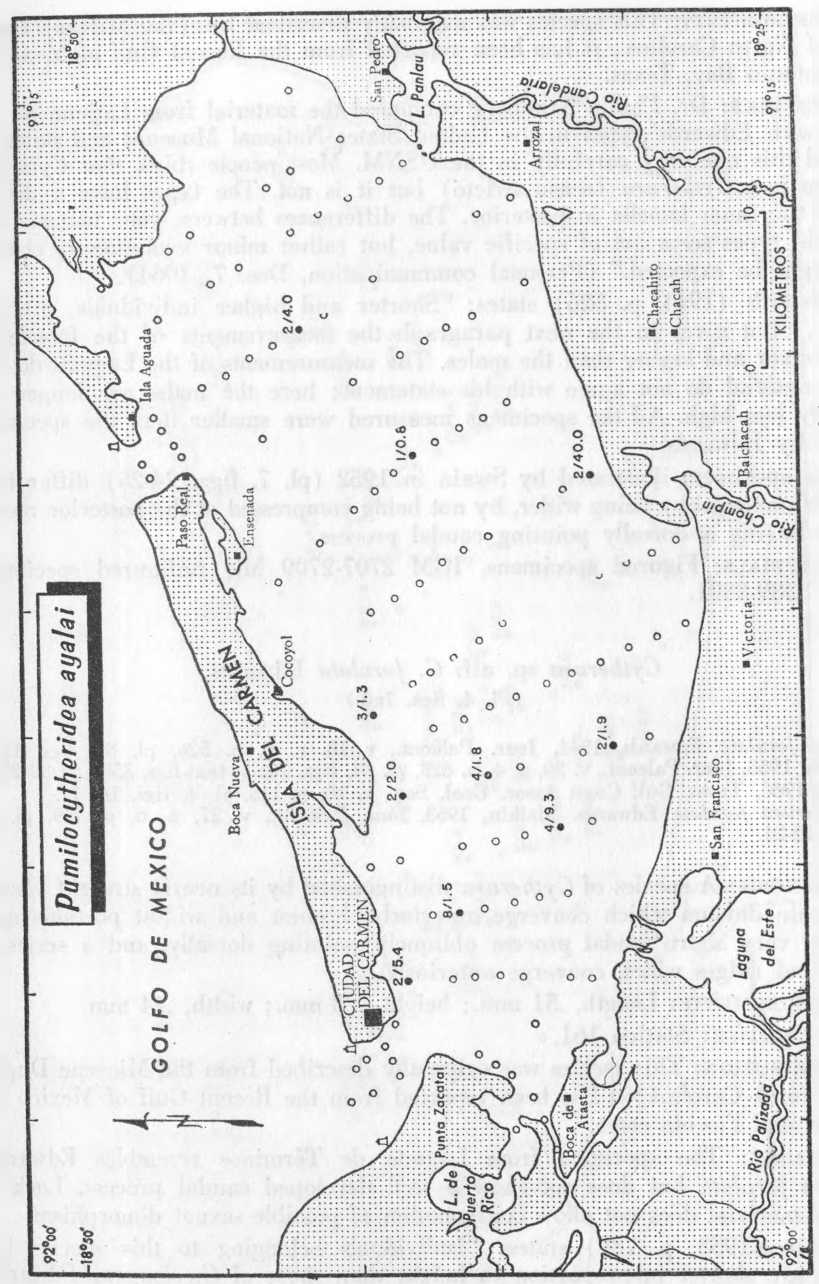

Fig. 21. Distribution of *Pumilocytheridea ayalai*.

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 Términos with Edwards' types in the United States National Museum 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 inner lamella in posterior. The differences between your material and Edwards' types seem not of specific value, but rather minor evolutionary changes that might be expected." (Personal communication, Dec. 7, 1964).

Edwards (1944, p. 526) states: "Shorter and higher individuals, probable females," but gives in the next paragraph the measurements of the females as being longer and higher than the males. The measurements of the Laguna de Términos material do not agree with his 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; unfigured specimens, H.V.H. 8389-8391.

Cytherura sp. aff. *C. forulata* Edwards
(Pl. 4, figs. 7a-b)

Cytherura forulata Edwards, 1944, Jour. Paleont., v. 18, n. 6, p. 526, pl. 88, figs. 17-20. Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 628, pl. 64, figs. 10a-c; text-figs. 35c and 39:2a, b. Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 115, pl. 4, figs. 16, 17.
Not *Cytherura forulata* Edwards. Malkin, 1953, Jour. Paleont., v. 27, n. 6, p. 789, pl. 80, figs. 22-24.

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

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

OCCURRENCE: 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 Texas and Florida coast.

REMARKS: The specimen from Laguna de Términos resembles Edwards' *Cytherura forulata* but does not show a well developed caudal process. Lack of abundant 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.

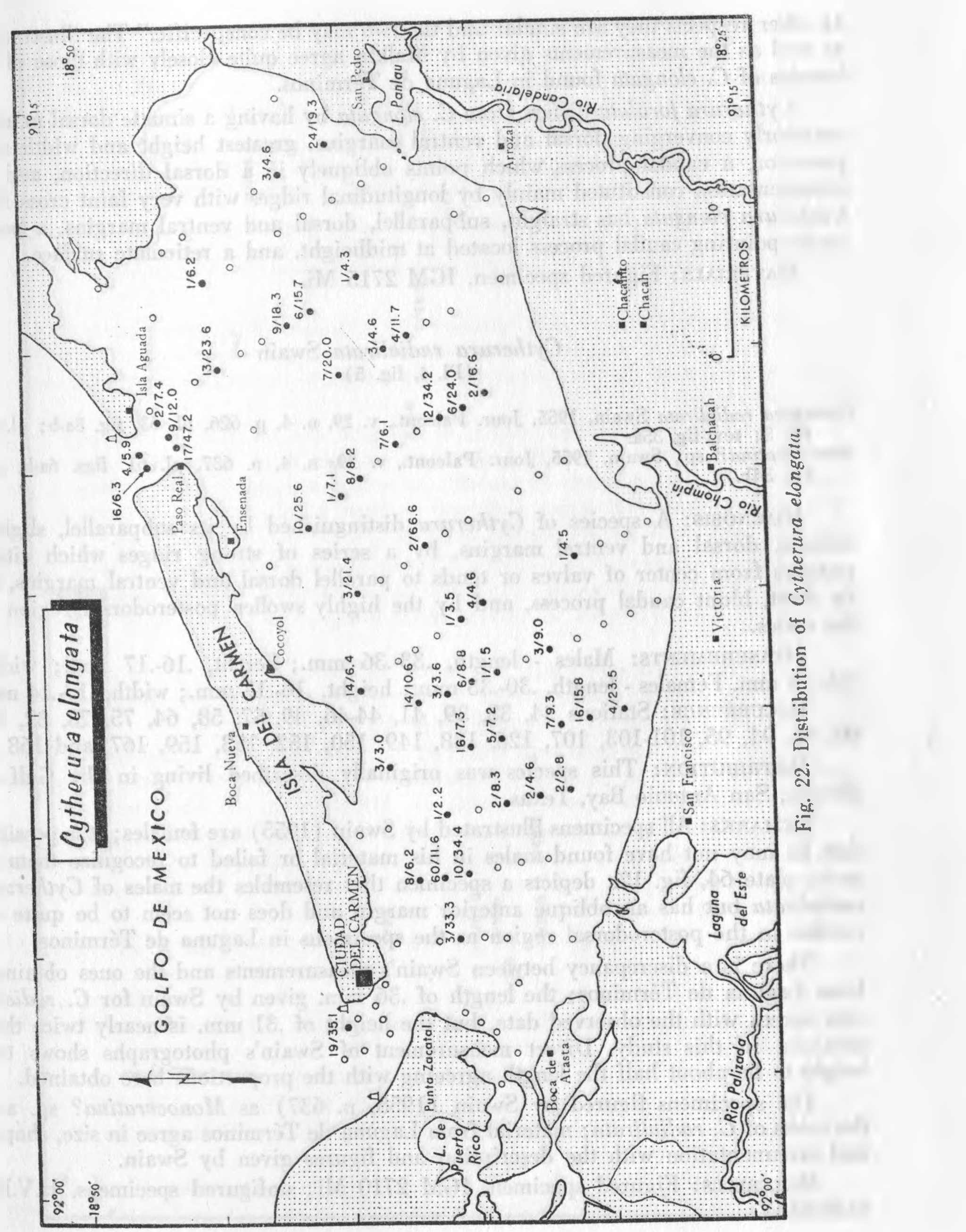

Fig. 22. Distribution of *Cytherura elongata*.

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 Términos.

Cytherura forulata differs from *C. elongata* by having a sinuate dorsal margin, anteriorly converging dorsal and ventral margins, greatest height and width near posterior, a caudal process which points obliquely in a dorsal direction, and an ornamentation constituted mainly by longitudinal ridges with very faint cross ribs. *Cytherura 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.

Cytherura radialirata Swain
(Pl. 4, fig. 5)

Cytherura radialirata Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 626, pl. 63, fig. 8a-b; pl. 64, fig. 3; text-fig. 35a.
Monoceratina? sp., Swain, 1955, Jour. Paleont., v. 29, n. 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 - length, .30-.33 mm.; height, .16-.17 mm.; width, .13-.14 mm.

OCCURRENCE: Stations 34, 38, 39. 41, 44-46, 49, 57, 58, 64, 75, 78, 82, 84, 90, 91, 94, 95, 101-103, 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 *Cytherura 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 Términos.

There is a discrepancy between Swain's measurements and the ones obtained from Laguna de Términos; the length of .36 mm. given by Swain for *C. radialirata* agrees with the observed data, but the height of .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 Términos agree in size, shape, and ornamentation with the description and figures given by Swain.

MATERIALS: Figured specimen, IGM 2710 Mi; unfigured specimens, H.V.H. 8140-8143.

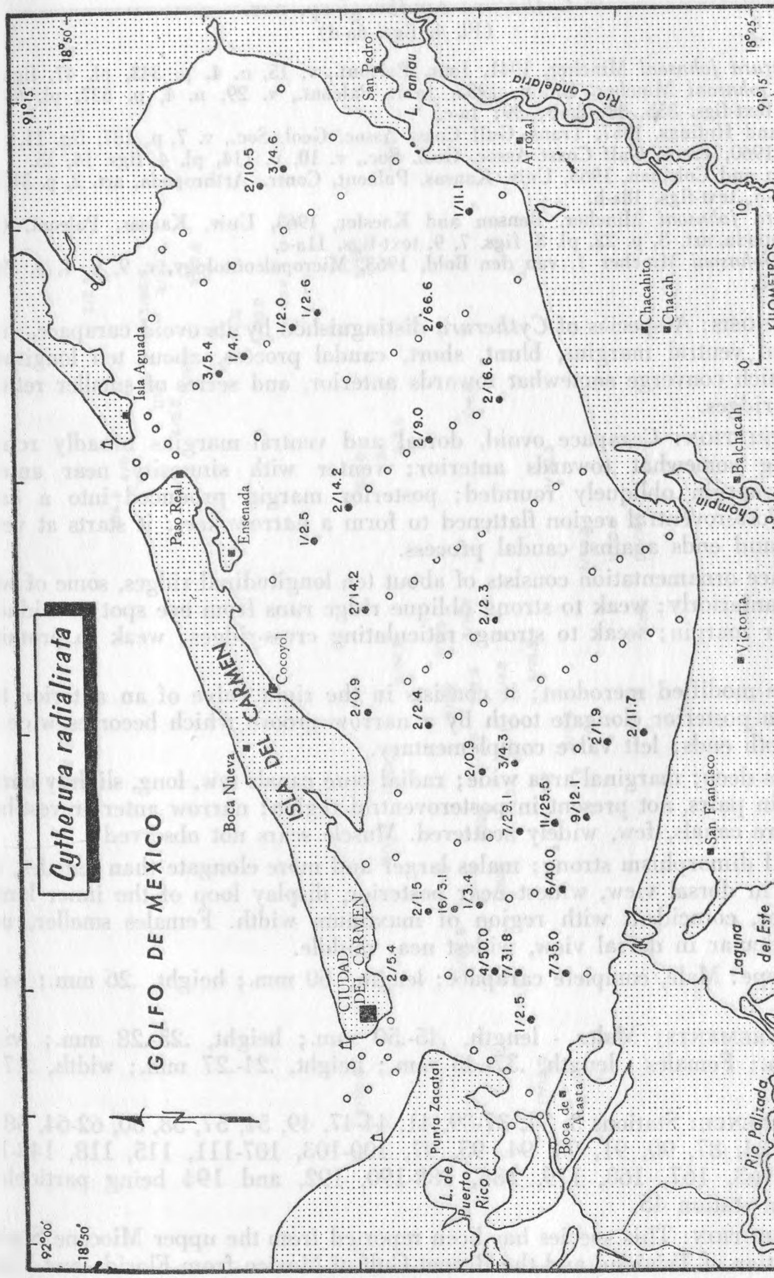

Fig. 23. Distribution of *Cytherura radialirata*.

Cytherura sandbergi sp. nov.
(Pl. 4, figs. 6a-d)

Not *Cytherura johnsoni* Mincher, 1941, Jour. Paleont., v. 15, n. 4, p. 343, pl. 47, figs. 1a-d.
Cytherura johnsoni Mincher. Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 627, pl. 64, figs. 8a-c; text-figs. 35b, 38: 8a-b; 39: 1a-c.
Puri and Hulings, 1957, Trans. Gulf Coast Assoc. Geol. Soc., v. 7, p. 187, fig. 11.
Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 114, pl. 4, figs. 14, 15.
Benson and Coleman, 1963, Univ. Kansas, Paleont, Contr., Arthropoda, art. 2, p. 31, pl. 6, figs. 1-5, text-figs. 18a-b.
? *Cytherura johnsoni* Mincher. Benson and Kaesler, 1963, Univ. Kansas, Paleont. Contr., Arthropoda, art. 3, p. 22, pl. 3, figs. 7, 9, text-figs. 11a-c.
Cytherura johnsoni Mincher ?. van den Bold, 1963, Micropaleontology, v. 9, n. 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 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: Stations 3, 34, 37-39, 41, 44-47, 49, 54, 57, 58, 60, 62-64, 68-70, 76, 79-81, 84, 87, 90, 91, 93, 94, 95, 97, 100-103, 107-111, 115, 118, 148-153, 155, 161, 163, 167, 168, 179, 186, 188-190, 192, and 194 being particularly abundant in station 45.

DISTRIBUTION: This species has been reported from the upper Miocene Springvale Formation of Trinidad and the Recent Gulf of Mexico from Florida and Texas.

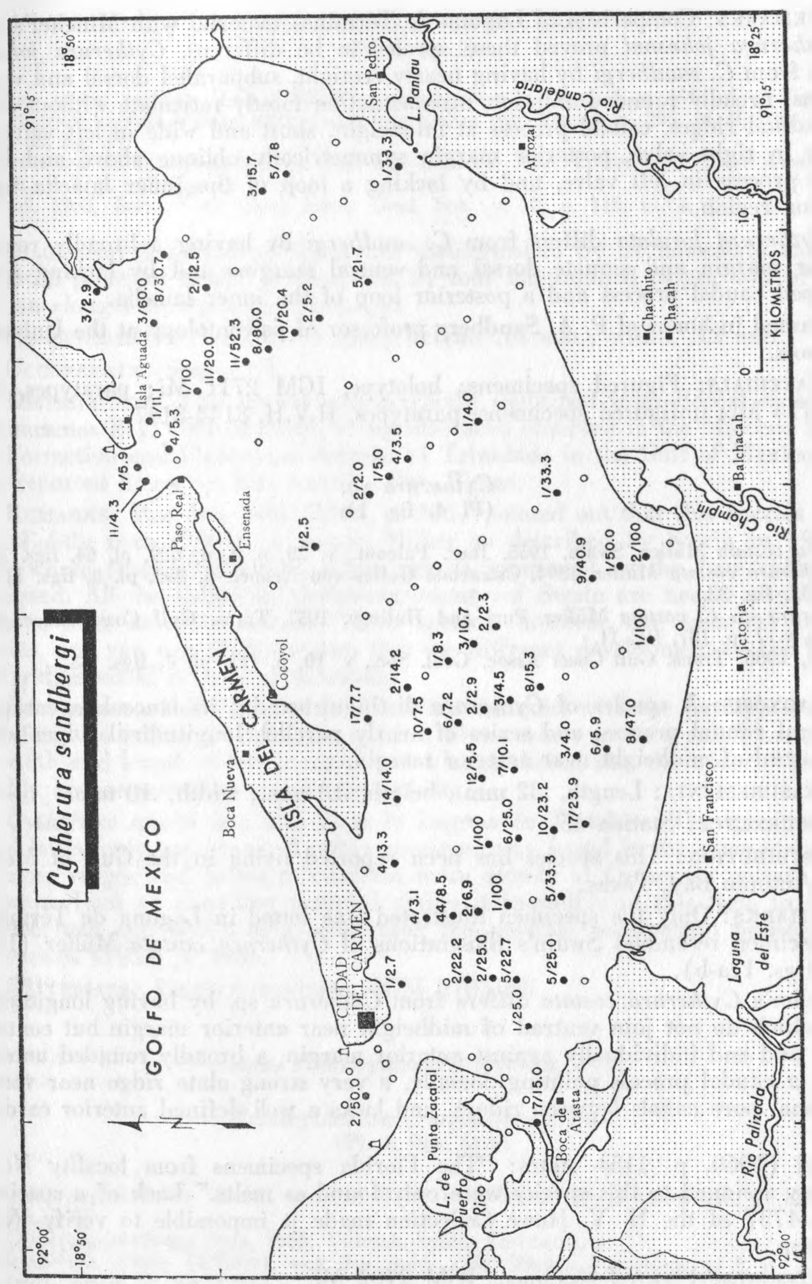

Fig. 24. Distribution of *Cytherura sandbergi*.

REMARKS: Comparison of Laguna de Términos material with Mincher's types of *Cytherura johnsoni* proved these species to be different. *Cytherura 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 and 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.

Cytherura jorulata differs from *C. sandbergi* by having a broadly rounded anterior margin and sinuate dorsal and ventral margins and by lacking a well developed caudal process and a posterior loop of the inner lamella.

Named in honor of P. A. Sandberg professor of paleontology at the University of Illinois.

MATERIALS: Figured specimens: holotype, IGM 2711 Mi; paratypes, IGM 2712-2714 Mi; unfigured specimens, paratypes, H.V.H. 8144-8147.

Cytherura sp.
(Pl. 4, fig. 1)

Cytherura costata Müller. Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 629, pl. 64, figs. 11a-b.
Not *Cytherura costata* Müller, 1894, Ostracoda Golfes von Neapel, p. 295, pl. 8, figs. 11, 15; pl. 32, fig. 33.
? *Cytherura* cf. *C. costata* Müller. Puri and Hulings, 1957, Trans. Gulf Coast Assoc. Geol. Soc., v. 7, p. 187, fig. 11.
Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 115, pl. 4, figs. 1-3.

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

MEASUREMENTS: Length, .32 mm.; heigth, .13 mm.; width, .10 mm.

OCCURRENCE: 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 Términos. This specimen resembles Swain's illustrations of *Cytherura costata* Müller (1955, pl. 64, figs. 11a-b).

Müller'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.

Cytherura swaini van den Bold
(Pl. 4, fig. 2)

Cytherura swaini van den Bold, 1963, Micropaleontology, v. 9, n. 4, p. 395, pl. 9, figs. 4a-b.
Not *Cytherura costata* Müller, 1894, Ostracoda Golfes von Neapel, p. 295, pl. 8, figs. 11, 15; pl. 32, fig. 33.
Not *Cytherura* cf. *C. costata* Müller. Puri and Hulings, 1957, Trans. Gulf Coast Assoc. Geol. Soc., v. 7, p. 187, fig. 11.
Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 115, pl. 4, figs. 1-3.

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: Station 45.

DISTRIBUTION: This species was originally described from 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* Müller 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 *Cytherura costata* of Swain are nearly parallel, but converge near anterior margin. These species, however, are identical in 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* Müller of Swain. Lack of abundant material makes it imposible 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.

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, Forhandl., p. 77.
Hemicytherura videns (Müller). van den Bold, 1957 Micropaleontology, v. 3, n. 3, p. 245, (part, not pl. 4, fig. 12).

Not *Cytheropteron videns* Müller, 1894, Ostracoda des Golfes von Neapel, p. 303, pl. 20, figs. 2, 8.
Hemicytherura cranekeyensis Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 115, pl. 4, figs. 4, 5.
Hemicytherura sp. van den Bold, 1963, Micropaleontology, v. 9, n. 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 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.

OCURRENCE: Stations 48, 102, 150, 189, 190, 192, and 194.

DISTRIBUTION: This species was originally described living in the Gulf of Mexico off the Florida coast; it has been reported from the Miocene Brasso and Tamaná 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 a greater number of pits. Most specimens observed showed three pits in the subcentral region.

MATERIALS: Figured specimens, IGM 2716-2717 Mi; unfigured specimens, H.V.H. 8148-8149.

Genus *Paracytheridea* G. W. Müller, 1894

Paracytheridea vandenboldi Puri
(Pl. 7, fig. 6)

Cytheropteron nodosum Ulrich and Bassler, 1904, Maryland Geol. Survey, Miocene, p. 129, pl. 38, figs. 37-40.
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.
van den Bold, 1946, Contr. Study Ostracoda, p. 86, pl. 16, fig. 14.
Swain, 1951, United States Geol. Surv., Prof. Paper 234-A, p. 51, pl. 3, figs. 19-22.
Paracytheridea vandenboldi Puri, 1953c, Jour. Paleont., v. 27, n. 5, p. 751.
Malkin, 1953, Jour. Paleont., v. 27, n. 6, p. 780, pl. 79, fig. 5.
Puri, 1954, Florida Geol. Surv., Bull. n. 36, p. 238, pl. 3, fig. 7, text-fig. 5a-b.
Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 625, pl. 62, figs. 2a-b.
McLean, 1957, Bull. American Paleont., v. 38, n. 167, p. 75, pl. 8, figs. 4a-b.
Not *Paracytheridea vandenboldi* Puri. Brown, 1958, North Carolina Dept. Conserv. and Dev., Bull. 72, p. 59, pl. 8, fig. 6.

DIAGNOSIS: A species of *Paracytheridea* distinguished by its rugose surface, strong subcentral node, posterodorsal swelling, strong ventral alae, and well marked subvertical sulcus.

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

OCCURRENCE: Station 193.

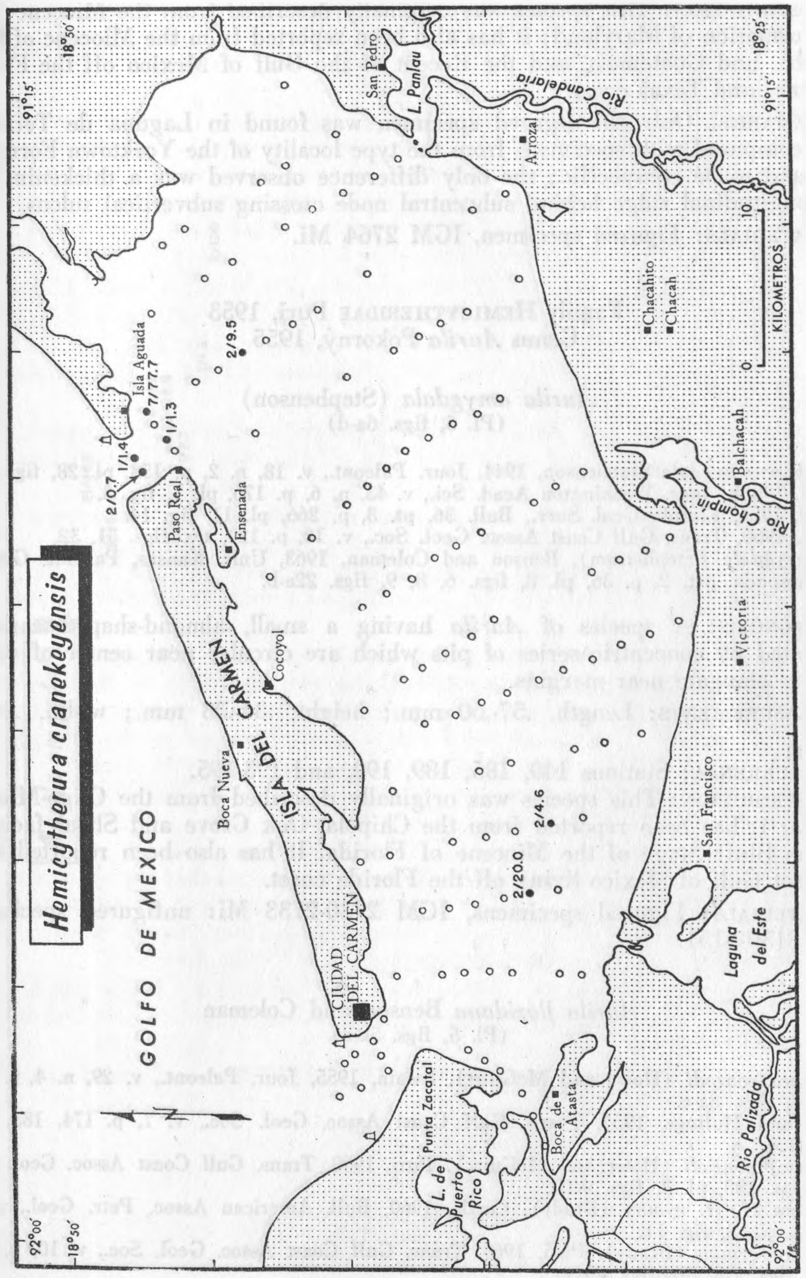

Fig. 25. Distribution of *Hemicytherura cranekeyensis*.

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 figured specimen was found in Laguna de Términos. It was compared with specimens 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.

Family HEMICYTHERIDAE Puri, 1953
Genus *Aurila* Pokorný, 1955

Aurila amygdala (Stephenson)
(Pl. 5, figs. 6a-d)

Hemicythere amygdala Stephenson, 1944, Jour. Paleont., v. 18, n. 2, p, 158, pl. 28, figs. 8, 9.
Puri, 1953b, Jour. Washington Acad. Sci., v. 43, n. 6, p. 176, pl. 1, fig. 3.
Puri, 1954, Florida Geol. Surv., Bull. 36, pt. 3, p. 266, pl. 11, fig. 14.
Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 129, text-figs. 31, 32.
Aurila amygdala (Stephenson), Benson and Coleman, 1963, Univ. Kansas, Paleont. Contrib., Arthropoda, art. 2, p. 36, pl. 8, figs. 6, 8, 9, figs. 22a-b.

DIAGNOSIS: A species of *Aurila* having a 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: Stations 149, 185, 189, 190, and 193-195.

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 Florida coast.

MATERIALS: Figured specimens, IGM 2730-2733 Mi: unfigured specimens, H.V.H. 8150-8151.

Aurila floridana Benson and Coleman
(Pl. 5, figs. 5a-d)

Hemicythere conradi (Howe and McGuirt). Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 635, pl. 62, figs. 3a-c.
Puri and Hulings, 1957, Trans. Gulf Coast Assoc. Geol. Soc., v. 7, p. 174, 183. 188, fig. 11:4.
Aurilia [sic] *conradi* (Howe and McGuirt). Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 130, pl. 3, figs. 9-10.
Hemicythere cf. *H. cymba* (Brady). Curtis, 1960, Bull. American Assoc. Petr. Geol., v. 44, p. 486, pl. 3, fig. 11.
Hemicythere cymba (Brady). Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 129, pl. 3, figs. 7-8, text-figs. 29-30.

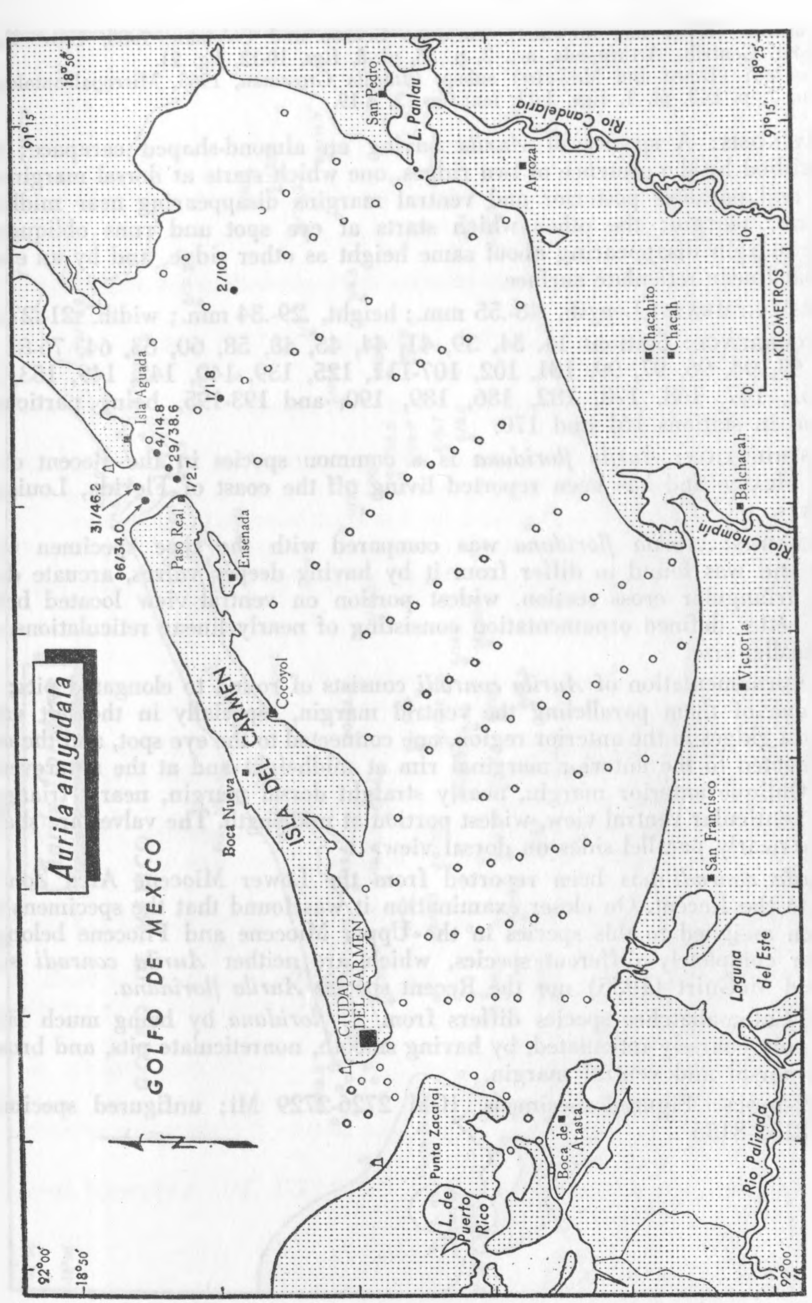

Fig. 26. Distribution of *Aurila amygdala*.

Aurila conradi (Howe and McGuirt) *floridana* Benson and Coleman, 1963, Univ. Kansas, Paleont. Contrib., Arthropoda, art. 2, p. 35, pl. 8, figs. 10-12, fig. 21.
Aurila conradi (Howe and McGuirt) subsp. *littorala* Grossman, 1965, Micropaleontology, v. 11, n. 2, p. 143, pl. 1, figs. 1-11, text-figs. 2, 4-19.

DIAGNOSIS: A species of *Aurila* having an almond-shaped carapace; it is distinguished 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; 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: Stations 14, 34, 39, 41, 44, 45, 48, 58, 60, 63, 64, 76-81, 87, 90, 91, 93, 94, 96, 97, 99, 101, 102, 107-111, 125, 139, 140, 142, 149, 153, 155, 160, 161, 167, 168, 170, 182, 186, 189, 190, and 193-195, 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 specimen 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, 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, nonreticulate pits, and broadly rounded dorsal and ventral margin.

MATERIALS: Figured specimens, IGM 2726-2729 Mi; unfigured specimens, H.V.H. 8152-8155.

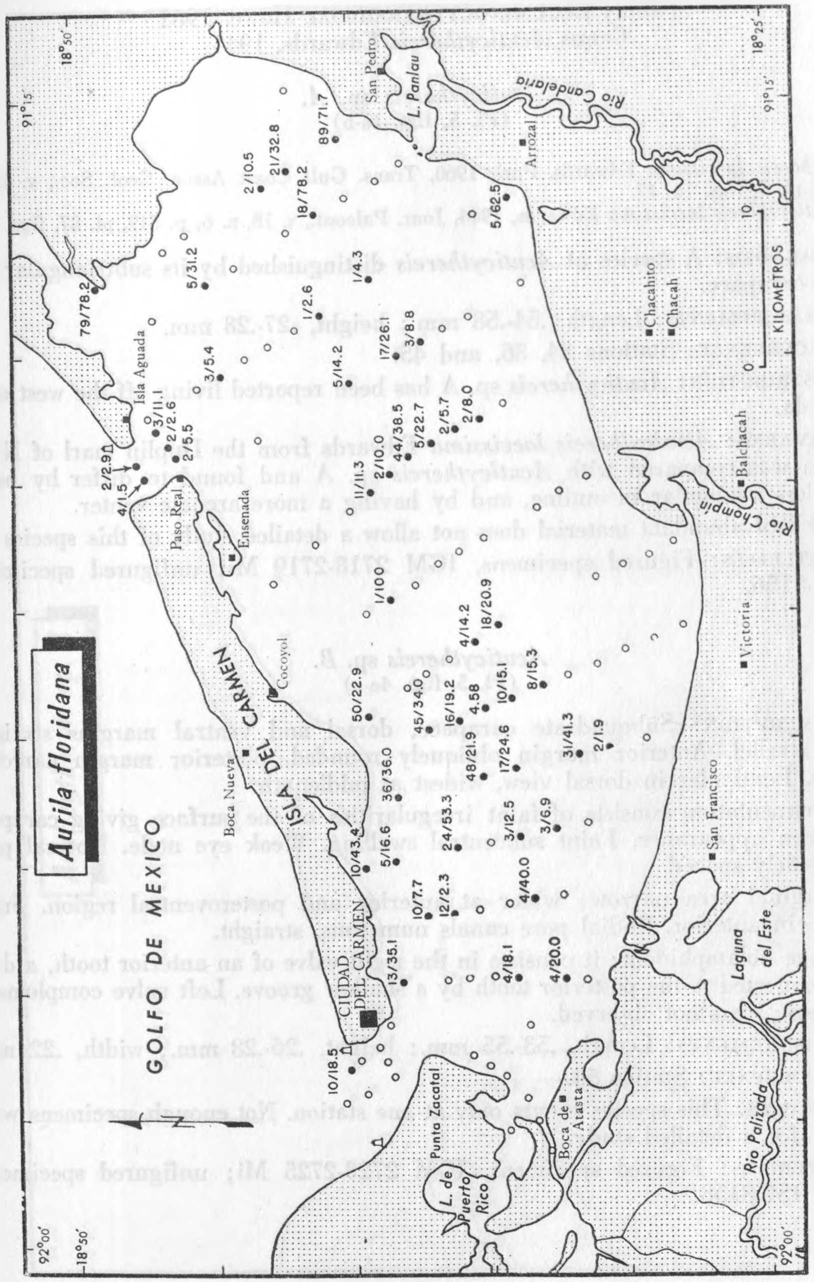

Fig. 27. Distribution of *Aurila floridana*.

Family Leguminocythereididae Howe, 1961
Genus *Acuticythereis* Edwards, 1944

Acuticythereis sp. *A.*
(Pl. 5, figs. 1a-b)

Acuticythereis laevissima Edwards. Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 128, pl. 2, figs. 16, 17.
Not *Acuticythereis laevissima* Edwards, 1944, Jour. Paleont., v. 18, n. 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: Stations 34, 36, and 45.

Distribution: *Acuticythereis* sp. A has been reported living off the west coast of Florida.

Remarks: *Acuticythereis laevissima* Edwards from the Duplin marl of North Carolina was compared with *Acuticythereis* sp. A and found to differ by being larger, less triangular in outline, and by having a more arcuate venter.

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

Materials: Figured specimens, IGM 2718-2719 Mi; unfigured specimens, H.V.H. 8156.

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.

Ornamentation consists of faint irregularities of the surface giving carapace a chagreen appearance. Faint subcentral swelling. Weak eye node. Normal pore canals widely spaced.

Marginal area narrow; wider at anterior and posteroventral 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: 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; unfigured specimens, H.V.H. 8157-8158.

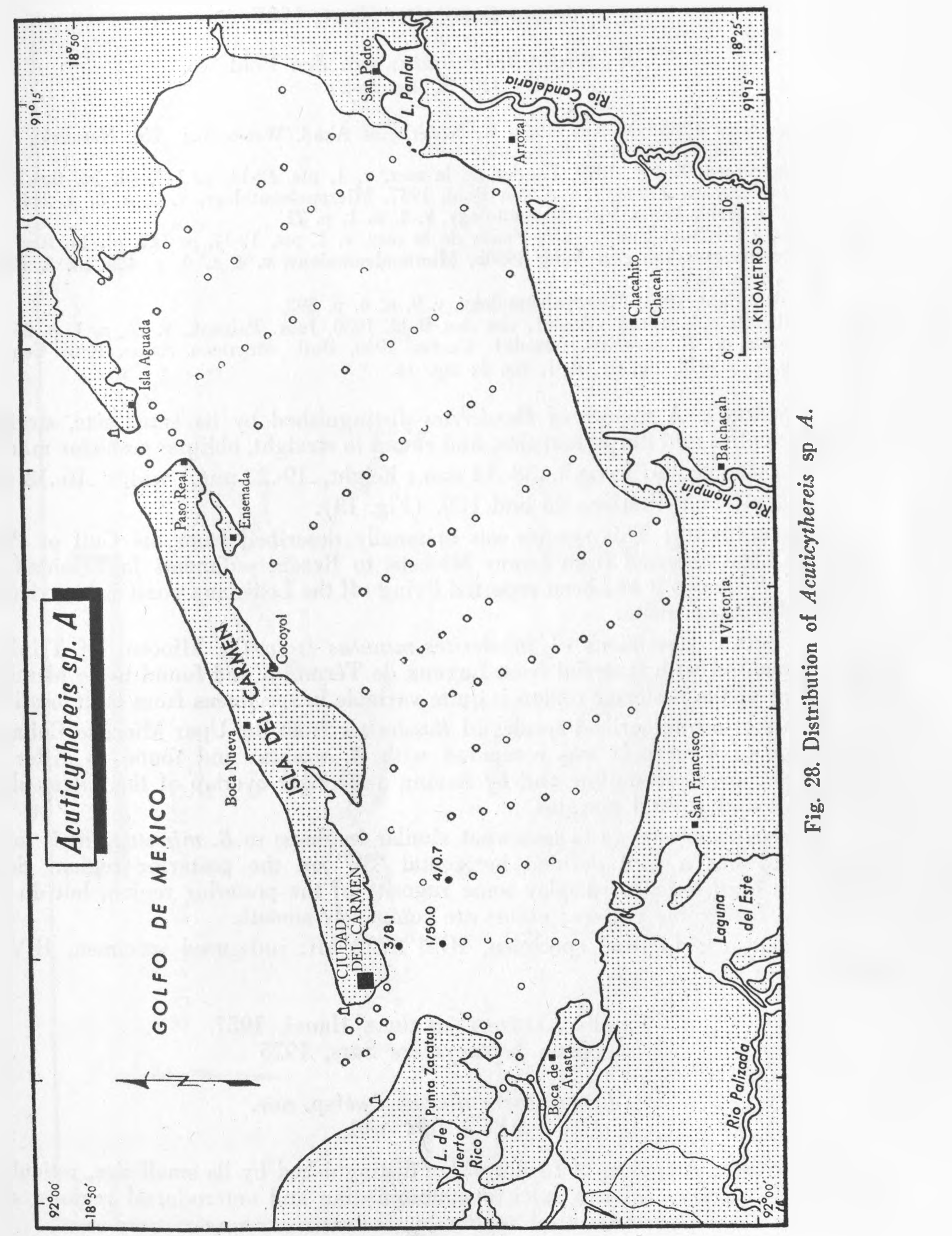

Fig. 28. Distribution of *Acuticythereis* sp *A.*

Genus *Basslerites* Howe, 1937

Basslerites minutus van den Bold
(Pl. 5, figs. 3a-b)

Basslerites teres (Brady). Key, 1954, K. Nederlands Akad. Wetensch.; Afd. Natuurk., Verh., ser. 1, v. 20, p. 224, pl. 5, figs. 2a-b.
Not *Cythere teres* Brady, 1870, Fondes de la mer, v. 1, pts. 12-14, p. 147, pl. 14, figs. 17-18.
Basslerites berchoni (Brady). van den Bold, 1957, Micropaleontology, v. 3, n. 3, p. 244.
van den Bold, 1958a, Micropaleontology, v. 4, n. 1, p. 71.
Not *Cythere berchoni* Brady, 1870, Fonds de la mer, v. 1, pts. 12-14, p. 117, pl. 14, figs. 3, 4.
Basslerites minutus van den Bold, 1958b, Micropaleontology, v. 4, n. 4, p. 405, pl. 3, fig. 8; pl. 5, figs. 5a-c.
van den Bold, 1963, Micropaleontology, v. 9, n. 4, p. 392.
Not *Basslerites miocenicus* (Howe). van den Bold, 1950, Jour. Paleont., v. 24, n. 1, p. 85.
? *Basslerites* cf. *B. berchoni* (Brady). Curtis, 1960, Bull. American Assoc. Petr. Geol., v. 44, n. 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: 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 Louisiana coast in the vicinity of the Mississippi delta.

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

A hitherto undescribed species of *Basslerites* from the Uper 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; unfigured specimen, H.V.H. 8159.

Family LEPTOCYTHERIDAE Hanai, 1957
Genus *Leptocythere* Sars, 1925

Leptocythere nikraveshae sp. nov.
(Pl. 5, figs. 2a-b)

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

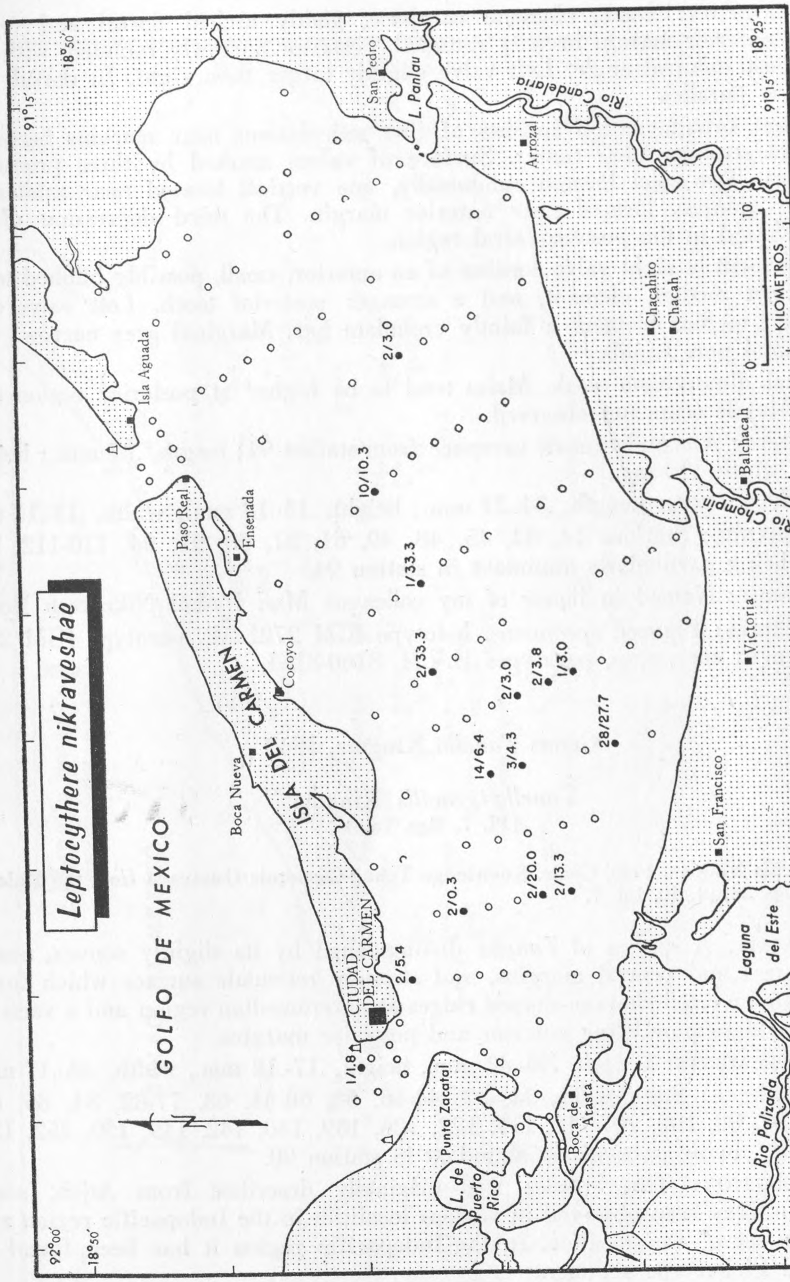

Fig. 29. Distribution of *Leptocythere nikraveshae*.

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.

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.

OCURRENCE: Stations 14, 34, 45, 48, 49, 61, 81, 90, 91, 94, 110-112, 124, and 140, being particularly abundant in station 94.

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

MATERIALS: Figured specimens, holotype IGM 2721 Mi, paratype IGM 2720 Mi; unfigured specimens, paratypes H.V.H. 8160-8161.

Genus *Tanella* Kingma, 1948

Tanella gracilis Kingma
(Pl. 7, figs. 1a-c)

Tanella gracilis Kingma, 1948, Contr. Knowledge 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 strongly reticulate surface which forms three to four inverted 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: Stations 14, 34, 37, 44-46, 58, 60-64, 68, 77-82, 84, 86, 87, 90, 91, 93-97, 99, 102, 107-112, 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 Recent and Pleistocene sediments.

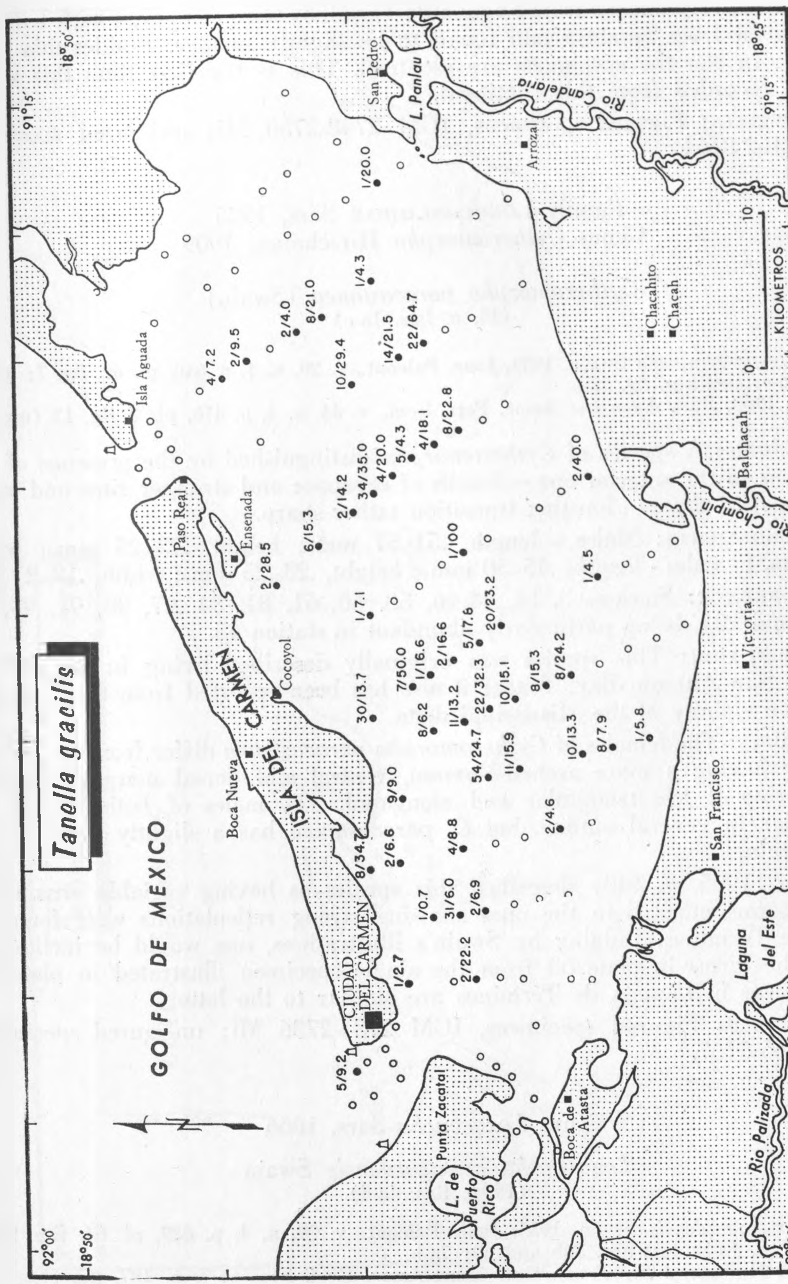

Fig. 30. Distribution of *Tanella gracilis*.

REMARKS: Specimens from Laguna de Términos 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. This is the first time this species has been recorded from this continent.

MATERIALS: Figured specimens, IGM 2748-2750 Mi; unfigured specimens, H.V.H. 8162-8164.

Family LOXOCONCHIDAE Sars, 1925
Genus *Cytheromorpha* Hirschman, 1909

Cytheromorpha paracastanea (Swain)
(Pl. 6, figs. 1a-c)

Leptocythere paracastanea Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 640, pl. 62, fig. 7; pl. 63; figs. 1a-c: text-figs. 39, 5a-b.
Curtis, 1960, Bull. American Assoc. Petr. Geol., v. 44, n. 4, p. 478, pl. 2, fig. 13 (top).

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: Stations 3, 14, 44-46, 58, 60, 61, 81, 84, 87, 90, 91, 93, 99, 107-112, and 124, being particularly abundant in station 45.

DISTRIBUTION: This species was originally described living in the Gulf of Mexico in San Antonio Bay, Texas; it also has 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 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 Términos. Judging by Swain's illustrations, one would be inclined to separate the forms in plate 63 from the single specimen illustrated in plate 62. The specimens in Laguna de Términos are similar to the latter.

MATERIALS: Figured specimens, IGM 2734-2736 Mi; unfigured specimens, H.V.H. 8165-8167.

Genus *Loxoconcha* Sars, 1866

Loxoconcha matagordensis Swain
(Pl. 6, figs. 4a-d)

Loxoconcha matagordensis Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 629, pl. 63, figs. 9a-b; pl. 64, figs. 1a-b; text-figs. 36b and 39: 7a-b.
Puri and Hulings, 1957, Trans. Gulf Coast Assoc. Geol. Soc., v. 7, p. 187, fig. 11.

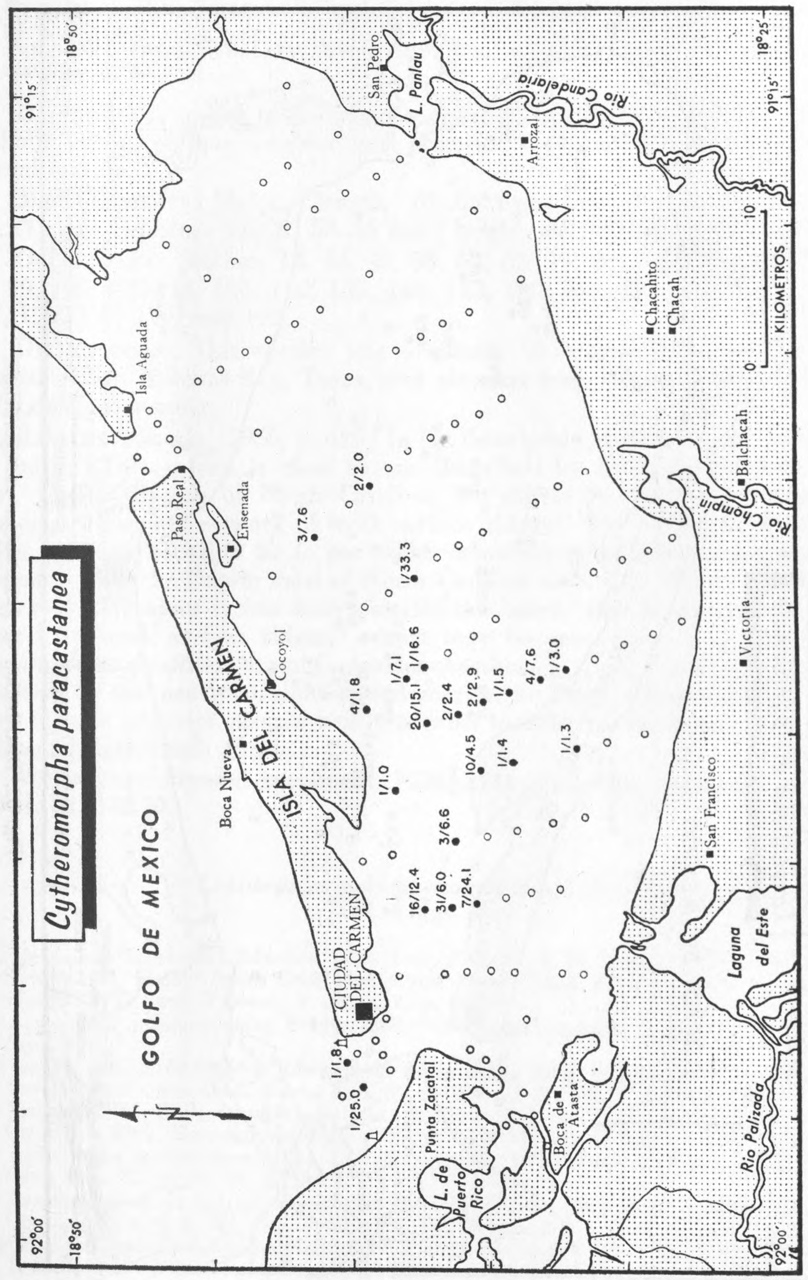

Fig. 31. Distribution of *Cytheromorpha paracastanea*.

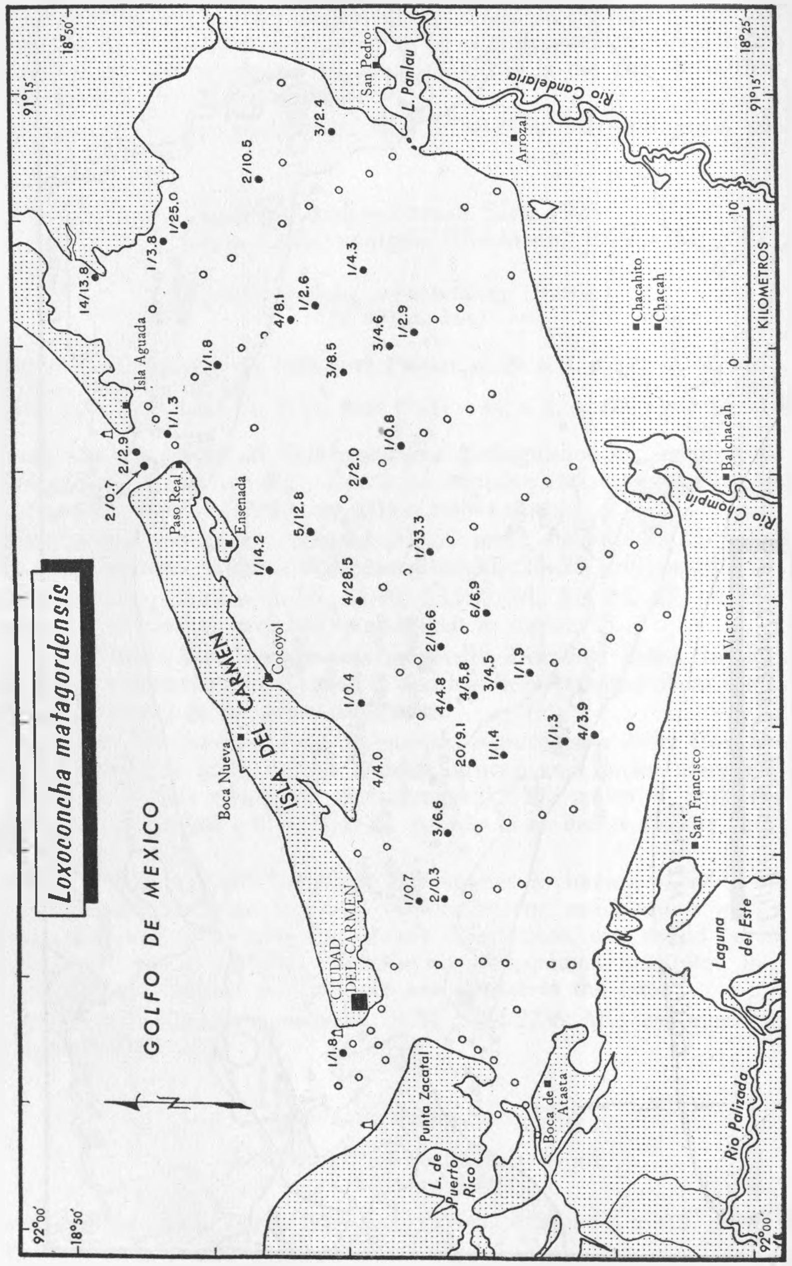

Fig. 32. Distribution of *Loxoconcha matagordensis.*

Byrne *et al.*, 1959, Trans. Gulf Coast Assoc. Geol. Soc., v. 9, p. 243, pl. 4, fig. 12, p. 245, pl. 5, fig. 10.
Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 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: Stations 14, 44, 45, 58, 62, 64, 79, 81, 84, 86, 87, 90, 91, 93, 94, 99, 102, 108-111, 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 also has been reported from the Florida and Louisiana coast.

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 Términos 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 the nearly straight dorsal margin in both valves, coarser pitting, a more oblique posterior margin nearly parallel to anterior margin, larger size, and different height-length ratio.

MATERIALS: Figured specimens, IGM 2744-2747 Mi; unfigured specimens, H.V.H. 8168-8170.

Loxoconcha purisubrhomboidea Edwards
(Pl. 6, figs. 3a-e)

Loxoconcha subrhomboidea Edwards, 1944, Jour. Paleont., v. 18, n. 6, p, 527, pl. 88, figs. 28-32.
Swain, 1951, United States Geol. Surv. Prof. Paper 234-A, pt. 1, p. 25, pl. 2, figs. 18, 19.
Malkin, 1953, Jour. Paleont., v. .27, n. 6, p. 787.
Not *Loxoconcha subrhomboidea* Brady, 1880, "Challenger" reports, v. 1, pt. 3, p. 121, pl. 28, figs. 4a-d.
Loxoconcha purisubrhomboidea Edwards, *in* Puri, 1953c, Jour. Paleont., v. 27, n. 5, p. 750.
Puri, 1954, Florida Geol. Surv., Bull. 36, p. 274, pl. 10, fig. 8, text-fig. 10h.
McLean, 1957, Bull. American Paleont., v. 38, n. 167, p. 71, pl. 7, figs. 4a-e.
Grossman, 1965, Micropaleontology, v. 11, n. 2, p. 148, pl. 2, figs. 1-11, text-figs. 3, 22-36.
Not *Loxoconcha purisubrhomboidea* Edwards. Brown, 1958, North Carolina Dept. Cons. and Dev., Bull. 72, p. 66, pl. 6, fig. 1.
Not *Loxoconcha* cf. *L. purisubrhomboidea* Edwards. Curtis, 1960, Bull. American Assoc. Petr. Geol., v. 44, n. 4, p. 481, figs. 5, 8; pl. 1, fig. 21; pl. 2, fig. 11 (top), fig. 16 (bottom).
Loxoconcha reticularis Edwards. Malkin, 1953, Jour. Paleont., v. 27, n. 6, p. 787, pl. 80, fig. 13, (not figs. 14-17 = *L. reticularis*).

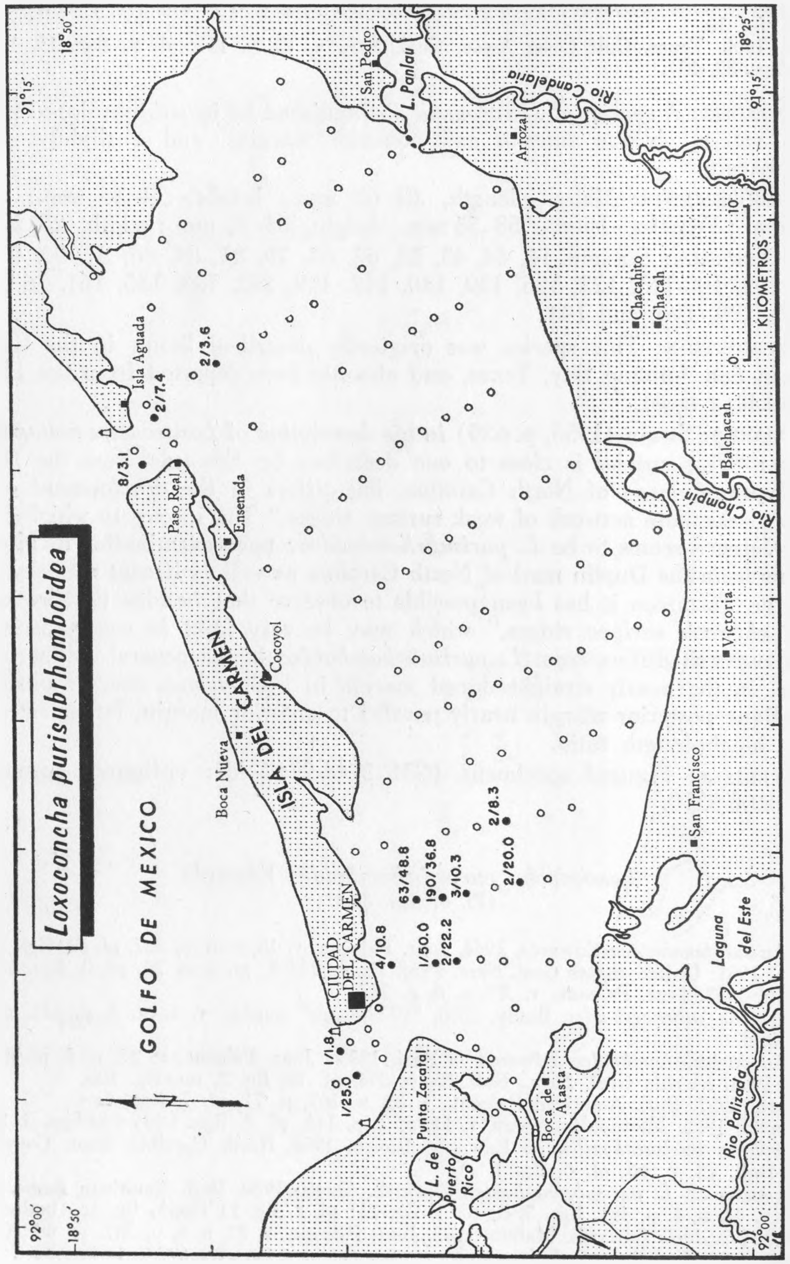

Fig. 33. Distribution of *Loxoconcha purisubrhomboidea.*

Diagnosis: A species of *Loxoconcha* distinguished by its finely and evenly pitted surface, flattened posterodorsal region 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: Stations 3, 10, 34, 36, 37, 44-46, 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 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 posterodorsal cardinal angle and 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; unfigured specimens, H.V.H. 8171-8173.

Loxoconcha sp. aff. *L. sarasotana* Benson and Coleman
(Pl. 6, figs. 2a-b)

Loxoconcha australis Brady. Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 630, pl. 63, fig. 11, (not pl. 64, fig. 2).
Curtis, 1960, Bull. American Assoc. Petr. Geol., v. 44, n. 4, p. 478, pl. 2, figs. 12 (top), 15 (bottom).
Loxoconcha cf. *L. australis* Brady. Curtis, 1960, Bull. American Assoc. Petr. Geol., v. 44, n. 4, pl. 3, fig. 4 (top).
Loxoconcha subrhomboidea Brady. Curtis, 1960, Bull. American Assoc. Petr. Geol., v. 44, n. 4, p. 478, pl. 2, fig. 12 (bottom); pl. 3, fig. 5 (top).
Loxoconcha sarasotana Benson and Coleman, 1963, Univ. Kansas, Paleont. Contr., Arthropoda, art. 2, p. 37, pl. 7, figs. 7-10; fig. 23a.

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

Measurements: Males - length, .57 mm.; height, .33 mm. Females - length .47-.53 mm.; height, .30-.33 mm.

Occurrence: Stations 68, 79, 102, and 103.

Distribution: *Loxoconcha sarasotana* was originally described from the Gulf of Mexico off the coast of Florida.

Remarks: This species has been referred to *Loxoconcha sarasotana*, the closest

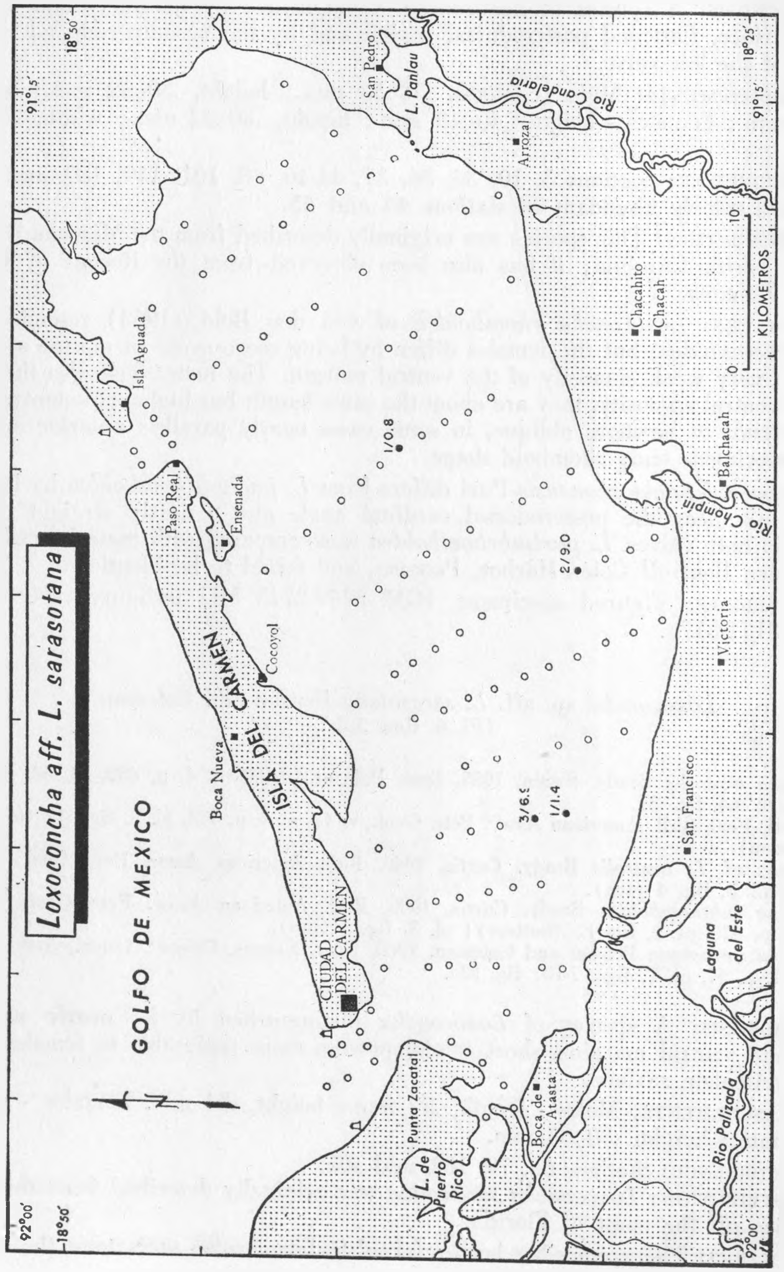

Fig. 34. Distribution of *Loxoconcha* sp. aff. *L. sarasotana.*

described species. It differs from *L. sarasotana* by the slightly different outline, ornamentation, and 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 at Grand Isle, Louisiana, and at Galveston beach and Corpus Christi, Texas. The specimen figured by Puri (1960, p. 111, figs. 33, 34, and 38) as *Loxoconcha australis* Brady is actually *L. sarasotana.* Lack of abundant material from Laguna de Términos makes it impractical at this time to erect a new species.

MATERIALS: Figured specimens, IGM 2737-2738 Mi; unfigured specimen, H.V.H. 8174.

Family PARADOXOSTOMATIDAE Brady and Norman, 1889
Subfamily CYTHEROMATINAE Elofson, 1938

Genus *Megacythere* Puri, 1960

Type-species: *Megacythere robusta* Puri, 1960, Trans., Gulf Coast Assoc. Geol. Soc., v. 10, 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 possible synonymy with the genus *Paracytheroma* (van den Bold, 1963, p. 408; Benson and Kaesler, 1963, p. 27). At the present time the acceptance of *Paracytheroma* is paleontologically impractical as this genus was conceived and described exclusively on soft parts without any consideration to carapace morphology. As 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. Paleont., v. 15, n. 4, p. 344, pl. 47, figs. 4a-d.
Puri, 1954, Florida Geol. Surv., Bull. 36, pt. 3, p. 290.
Swain, 1955, Jour. Paleont., v. 29, n. 4, p. 641, pl. 63, figs. 2a-c; pl. 64, fig. 7, text-fig. 39:3.
van den Bold, 1957, Micropaleontology, v. 3, n. 3, p. 327, pl. 4, fig. 1.
Curtis, 1960, Bull. American Assoc. Petr. Geol., v. 44, n. 4, p. 478, pl. 3, fig. 13.
Cytherura similis Sars var. *meridionalis* van den Bold, 1946, Contr. study Ostracoda Caribbean Region, p. 119, pl. 9, figs. 21a-b.
? *Paracytheroma costata* Hartmann, 1957, Kieler Meerforschungen, v. 13, n. 1, p. 158, figs. 124-130.
Hartmann, 1957, Comunicaciones, Year 6, n. 3-4, p. 107, figs. 124-130.
Megacythere johnsoni (Mincher). Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 122.
Benson and Kaesler, 1963, Univ. Kansas Paleont. Contr., Arthropoda, art. 3, p. 28, pl. 3, figs. 3, 4; text-figs. 16a-c.
Megacythere meridionalis van den Bold, 1961, Kon. Nederlands Akad. Wetensch. Proc., ser. B., v. 64, n. 5, p. 637, figs. 10a-b.
Paracytheroma johnsoni (Mincher)? van den Bold, 1963, Micropaleontology, v. 9, n. 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.

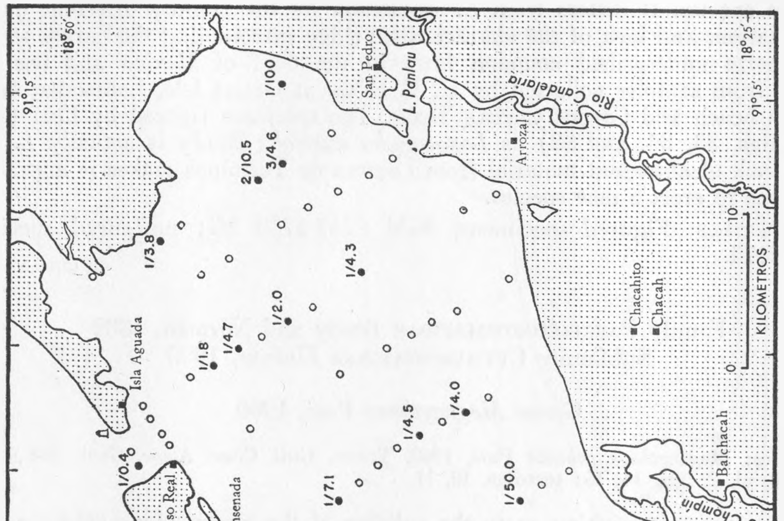

Fig. 35. Distribution of *Megacythere johnsoni.*

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

OCCURRENCE: Stations 41, 45, 46, 49, 54, 57, 60, 76, 78, 82, 93, 99, 101-103, 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 Términos 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, whereas in Laguna de Términos some specimens have a slightly sinuate dorsal margin behind the 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 (1941). The length of the topotype specimens 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 is in their size, van den Bold's specimen being slightly larger. The protruding ventral rib illustrated by van den Bold (figure 10a) probably was present only in that specimen.

MATERIALS: Figured specimens, IGM 2751-2752 Mi; unfigured specimens, H.V.H. 8175-8176.

Megacythere stephensoni (Puri)
(Pl. 7, figs. 5a-d)

Microcythere stephensoni Puri, 1954, Florida Geol. Surv., Bull. 36, pt. 3, p. 291, pl. 16, figs. 11, 12; text-figs. 12g, h.
Microcythere cf. *M. stephensoni* Puri. Curtis, 1960, Bull. American Assoc. Petr. Geol., v. 44, n. 4, p. 478, pl. 2, fig. 17.
Megacythere stephensoni (Puri). Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 122.

DIAGNOSIS: A species of *Megacythere* distinguished by its subovate carapace, smooth valves, higher posterior, and few, arcuate, branching radial pore canals.

MEASUREMENTS: Length, .51-.55 mm.; height, .27-.28 mm.; width, .17-.20 mm.

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

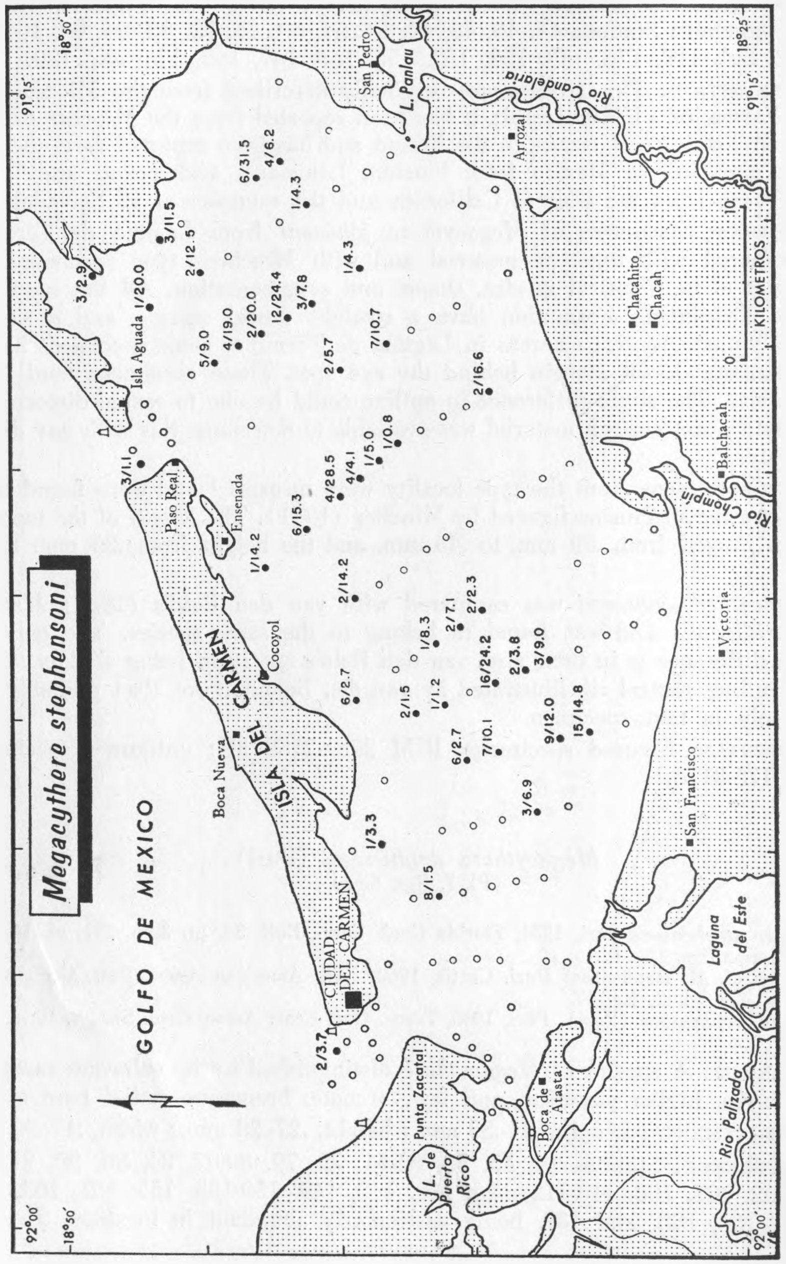

Fig. 36. Distribution of *Megacythere stephensoni.*

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

MATERIALS: Figured specimens, IGM 2760-2763 Mi; unfigured specimens, H.V.H. 8177-8179.

Genus *Pellucistoma* Coryell and Fields, 1937

Pellucistoma magniventra Edwards
(Pl. 7, figs. 4a-d)

Pellucistoma magniventra Edwards, 1944, Jour. Paleont., v. 18, n. 6, p. 528, pl. 89, figs. 33-35. van den Bold, 1950, Jour. Paleont., v. 24, n. 1, p. 86.
Puri, 1954, Florida Geol. Surv. Bull. 36, p. 289, pl. 15, fig. 4, text. fig. 12a.
Puri and Hulings, 1957, Trans. Gulf Coast Assoc. Geol. Soc., v. 7, p. 187, fig. 11:6.
Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 119, pl. 2, figs. 10-11; text-figs. 8,9.
Benson and Coleman, 1963, Univ. Kansas, Paleont. Contr., Arthropoda, art. 2, p. 41, figs. 26a-c; pl. 6, fig. 11.
? *Pellucistoma magniventra* Edwards. van den Bold, 1957, Micropaleontology, v. 3, n. 3, p. 246.
Not *Pellucistoma magniventra* Edwards. van den Bold, 1963, Micropaleontology, v. 9, n. 4, p. 404, pl. 10, fig. 6.
Pellucistoma cf. *P. magniventra* Edwards. Swain, 1951, United States Geol. Surv. Prof. Paper 234-A, part 1, p. 52.
Paradoxostoma ensiforme Brady. Swain, 1955, Jour. Paleont., v. 29, n. 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: 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 Términos 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.

MATERIALS: Figured specimens, IGM 2756-2759 Mi; unfigured specimens, H.V.H. 8180-8181.

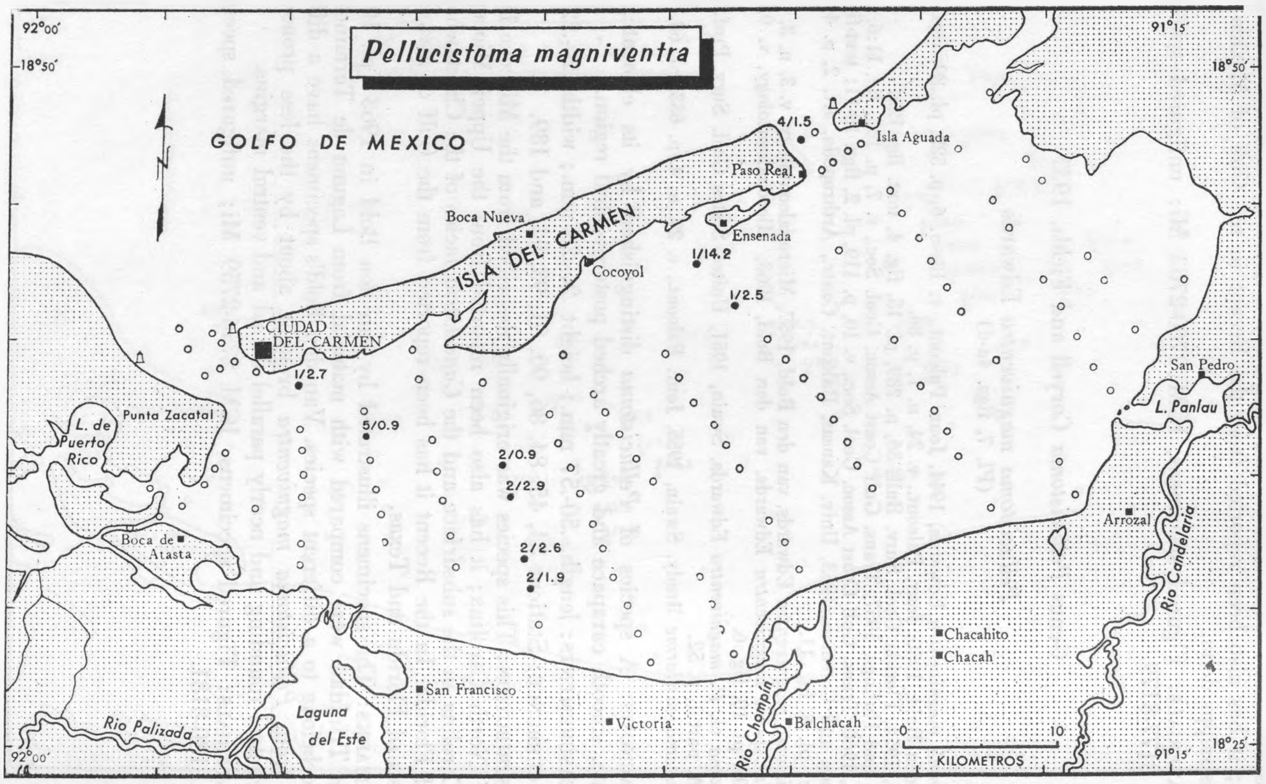

Fig. 37. Distribution of *Pellucistoma magniventra.*

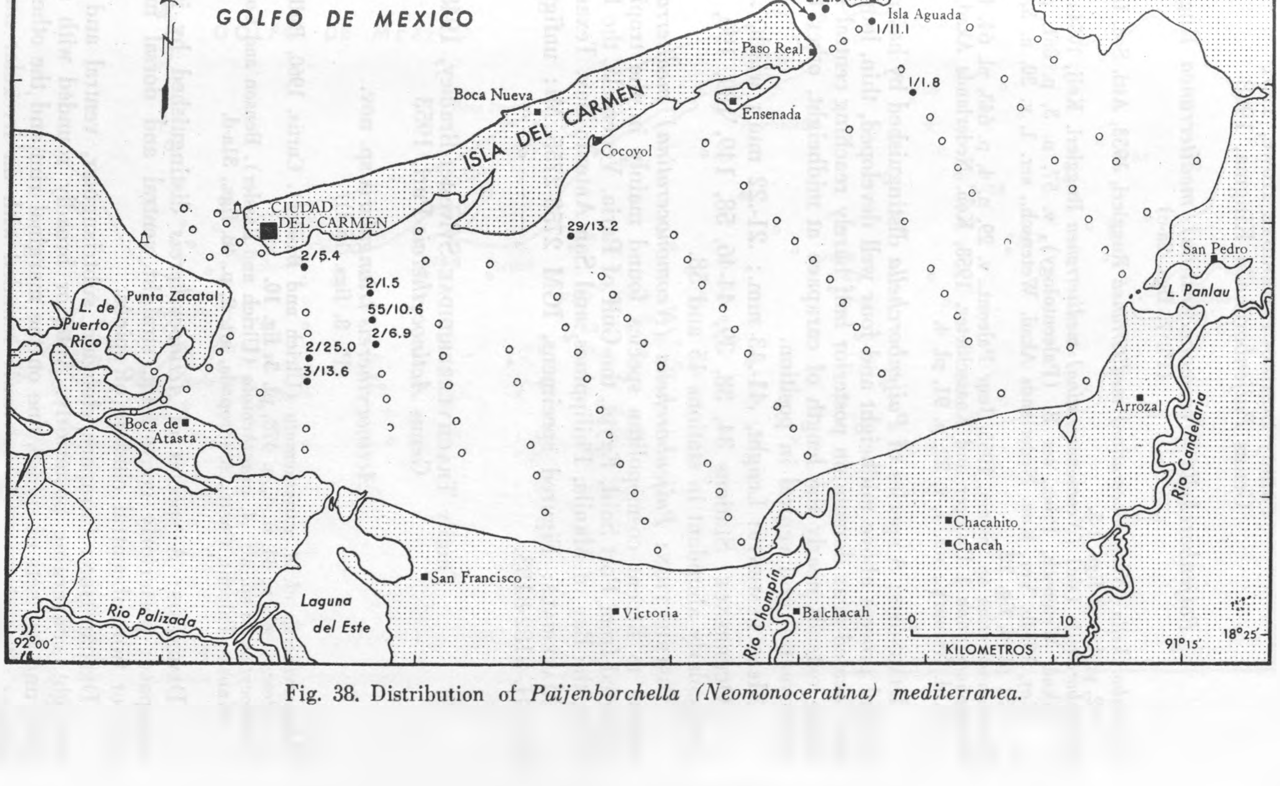

Fig. 38. Distribution of *Paijenborchella (Neomonoceratina) mediterranea.*

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., v. 92, p. 4, text-figs. 1-5.
Payenborchella [sic] *(Neomonoceratina) mediterranea* Ruggieri. Keij, 1954a, Kon. Nederlands Akad. Wetensch, Proc., ser B. (Paleontology), v. 57, n. 3, p. 361. pl. 13. figs. 12-13. Key, 1954b. Ver. Kon. Nederlands Akad. Wetensch., ser. 1, v. 20, n. 5, p. 228, pl. 5, fig. 15; pl. 6, fig. 12.
Neomonoceratina sp. Swain, 1955, Jour Paleont., v. 29, n. 4, p. 643, pl. 64, fig. 15.
Neomonoceratina 1 Drooger and Kaasschieter, 1958, Kon. Nederlands Akad. Wetensch., Verh. Afd. Natuurk., ser. 1, v. 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: Lenght, .41-.43 mm.; .21-.22 mm.; width, .18-.20 mm.

Ocurrence: Stations 34, 38, 39, 44-46, 58, 149, 189, 190, and 192, being particularly abundant in stations 45 and 58.

Distribution: *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; unfigured specimens, H.V.H. 8182-8183.

Family Trachyleberididae Sylvester-Bradley, 1948
Genus *Actinocythereis* Puri, 1953

Actinocythereis triangularis sp. nov.
(Pl. 8, figs. 1a-d)

Actinocythereis cf. *A. exanthemata* (Ulrich and Bassler). Curtis, 1960, Bull. American Assoc. Petr. Geol., v. 44, n. 4, p. 478, pl. 3, fig. 10.
Actinocythereis sp. aff. *A. exanthemata* (Ulrich and Bassler). Benson and Coleman, 1963, Univ. Kansas, Paleont. Contr., Arthropoda, 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 subcentral 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.

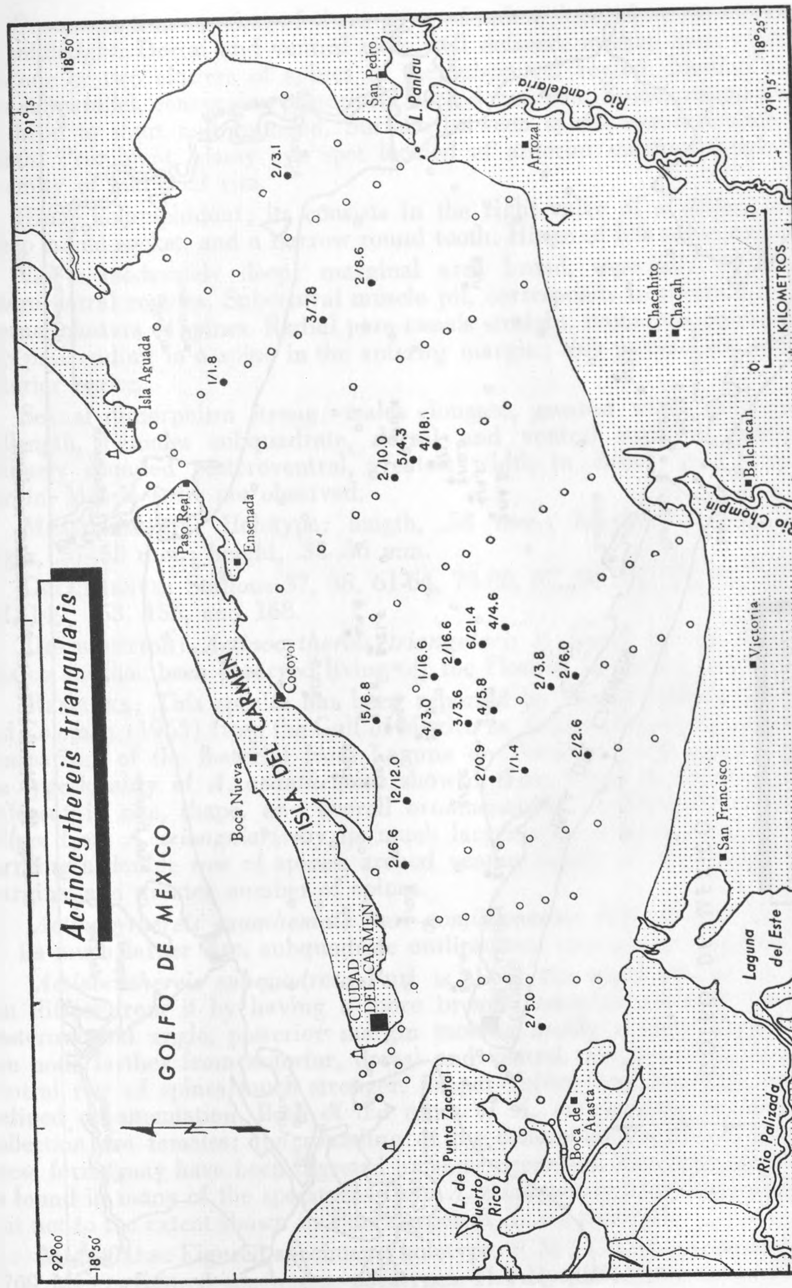

Fig. 39. Distribution of *Actinocythereis triangularis.*

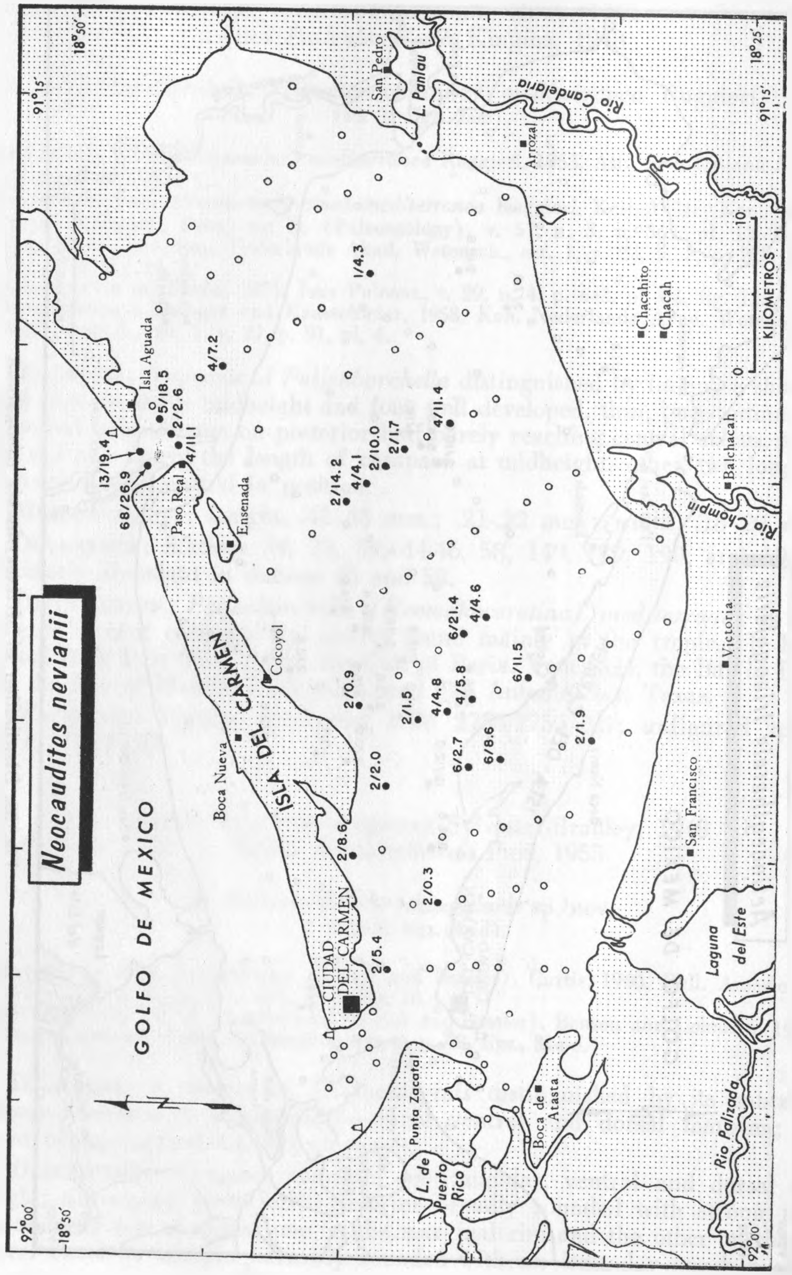

Fig. 40. Distribution of *Neocaudites nevianii.*

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; its 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-.58 mm.; height, .33-.36 mm.

OCCURRENCE: Stations 57, 58, 61-64, 78-80, 87, 90, 91, 93, 97, 107-109, 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 Florida, Louisiana, and Mexico coast.

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 Términos 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. *Actinocythereis 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 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 may have been digested by some organism. The same type of rounding is found in many of the specimens from *A. triangularis* from Laguna de Términos but not to the extent shown in Puri's types of *A. subquadrata.*

MATERIALS: Figured specimens, holotype, IGM 2770 Mi, paratypes, IGM 2766-2769 Mi; unfigured specimens, paratypes, H.V.H. 8184-8186.

Genus *Neocaudites* Puri, 1960

Neocaudites nevianii Puri
(Pl. 8, figs. 3a-c)

Rectotrachyleberis cf. *R. triplistriata* (Edwards). Puri, 1954, Florida Geol. Surv., Bull. 36, p. 264, pl. 11, figs. 1-2.
Neocaudites nevianii Puri, 1960, Trans. Gulf Coast Assoc. Geol. Soc., v. 10, p. 127, pl. 1, figs. 13-14; text-figs. 24a-c.
Neocaudites triplistriatus (Edwards). van den Bold, 1963, Micropaleontology, v. 9, n. 4, p. 389, pl. 8, fig. 4.
Neocaudites nevianii Puri ?. van den Bold, 1963, Micropaleontology, v. 9, n. 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 subcentral node to form somewhat of a horizontal "Y", and by a 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: Stations 34, 45, 63, 64, 77, 79, 80-82, 87, 90, 91, 94, 96, 107-109, 111, 149, 155, 189, 190, and 193-195, 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 deptths of 30 feet (van den Bold, personal communication).

Puri (1960, p. 127) in his original description of *Neocaudites nevianii* 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 nevianii* 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 nevianii*, rendering it more quadrate in lateral view, and thus, modifying the posterior outline.

Neocaudites nevianii is a very variable form, and it is very possible that it may be the same as *N. triplistriata* of Edwads; 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 Caloosahatchee from Florida, and Recent from Laguna de Términos brought forth certain similarities and discrepancies. The females in the three horizons are very similar; the males in the Caloosahatchee 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, the fossil forms being slightly larger. The Miocene forms from Trinidad and the material from Laguna de Términos 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 Términos 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 single row on the dorsal margin.

MATERIALS: Figured specimens, IGM 2773-2775 Mi; unfigured specimens, H.V.H. 8187-8189.

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, Trans., Gulf Coast Assoc. Geol. Soc., v. 7, p. 188, fig. 11.
Puri and Vernon, 1959, Florida Geol. Surv. Spec. Publ., n. 5, p. 243 (not pl. 151, 154, 156, 182, 197, 206 = *Orionina vaughani*).
Puri, 1960, Trans., Gulf Coast Assoc. Geol. Soc., v. 10, p. 123, 126, pl. 1, figs. 15, 16.
Not *Orionina bermudae* (Brady). van den Bold, 1957, Micropaleontology, v. 3, n. 3, p. 242, table I [= *Orionina vaughani* (*Ulrich and Bassler*)], pl. 1, fig. 12, (= *Orionina similis* van den Bold).
van den Bold, 1958b, Micropaleontology, v. 4, n. 4, p. 403, (= p.p. *Orionina vaughani*, p.p. *Orionina* sp. aff. *O. bradyi*) pl. 5, fig. 9 (= *Orionina serrulata*).
Orionina bradyi van den Bold, 1963a, Jour. Paleont., v. 37, n. 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: 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* is 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 can be distinguished from *O. serrulata* by the much simpler construction of the marginal area.

According to van den Bold (1963, p. 47) specimens that are exteriorly very similar to *Orionina bradyi* have been found associated with *O. vaughani* in the

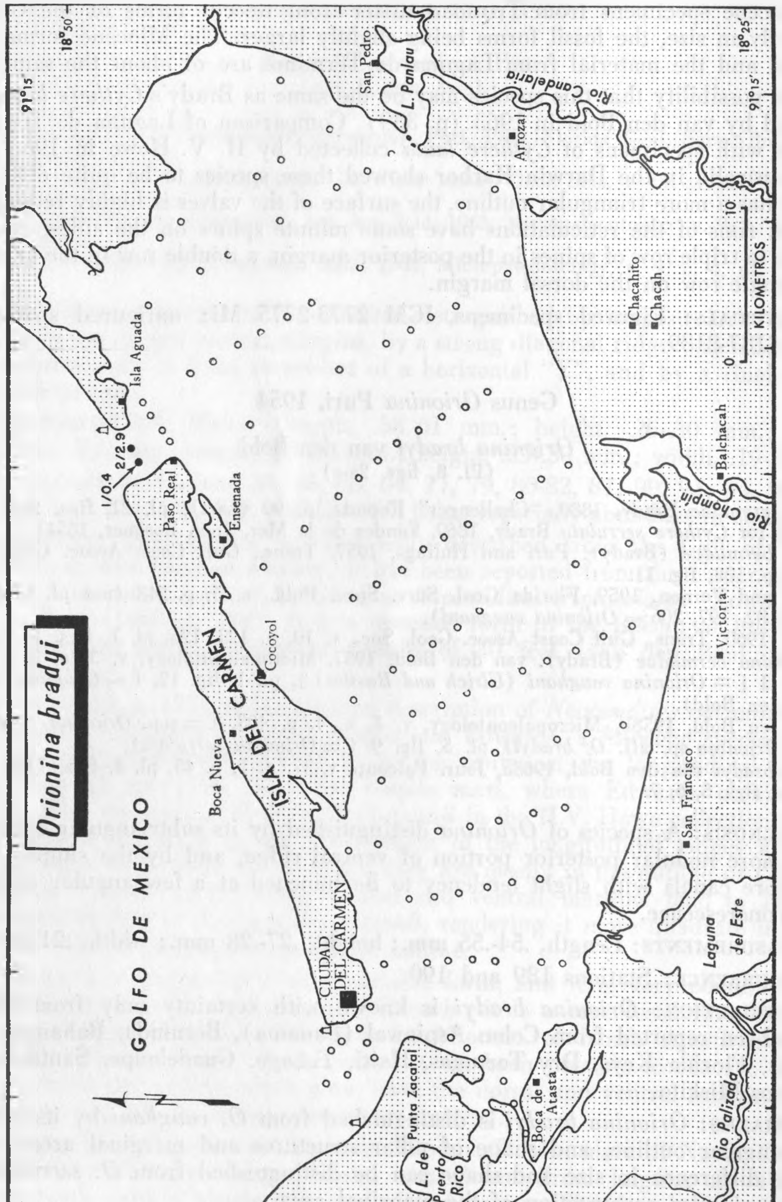

Fig. 41. Distribution of *Orionina bradyi.*

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* sp. aff. *O. bradyi* but may be young molts of *O. vaughani*, although in some samples no adult forms of *O. vaughani* have been found. 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.

Family XESTOLEBERIDIDAE Sars, 1928

Genus *Xestoleberis* Sars, 1866

Xestoleberis rigbyi sp. nov.
(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 dorsad 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.; width, .30 mm.

MEASUREMENTS: Length, .47-.53 mm.; height, .31-.34 mm.; width, .28-.30 mm.

OCCURRENCE: Stations 30, 44, 45, 53, 58, 62, 78, 79, 84, 86, 87, 93, 96, 97, 99, 103, 107, 110, 168, 189, 190, and 193-195, 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)

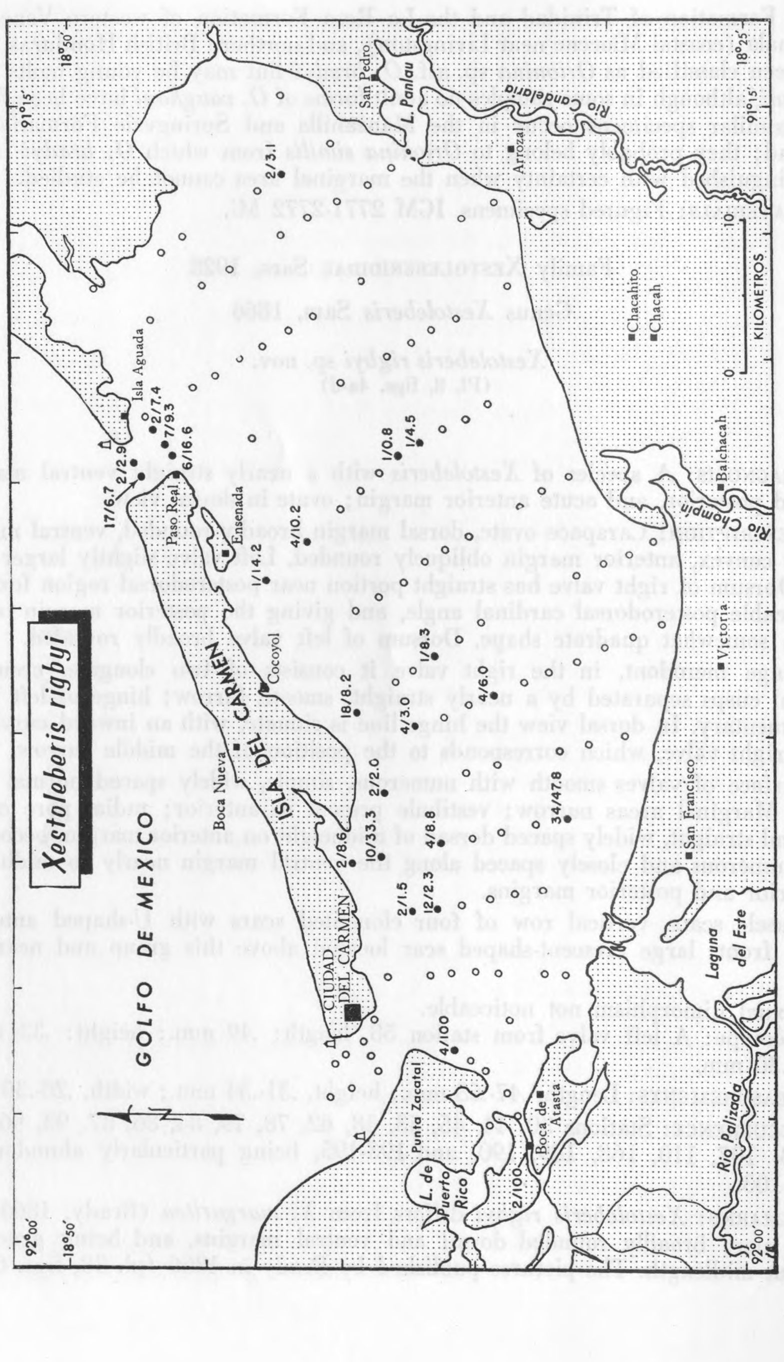

Fig. 42 Distribution of *Xestoleberis rigbyi*.

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.

Xestoleberis intermedia Brady differs from *X. rigbyi* by being more elongate, produced posteriorly, and slightly rounded ventrally, and by having a depressed rim; 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, professor of paleontology at Brigham Young University.

MATERIALS: Figured specimens, holotype, IGM 2779 Mi, paratypes, IGM 2776-2778 Mi; unfigured specimens, paratypes, H.V.H. 8190-8192.

CONCLUSIONS

The ostracode fauna of Laguna de Términos is composed for the most part of euryvalent species. Ecologic requirements vary widely from one species to another within a genus, and using a single genus as environment indicator may result in inaccuracies in paleoecologic work. In the genus *Aurila*, for example, *A. amygdala* is a marine form restricted to areas of high salinity but *A. floridana* does not show a marked preference for any particular environment. These species are for the most part mutually exclusive and of completely different tolerances. Another example is the genus *Perissocytheridea*, in which *P. bicelliforma* is restricted to an area of oyster banks and low salinity and *P. excavata* is restricted to the shores of the lagoon, but *P. rugata* and *P. brachyforma* do not show appreciable preference for any particular ecologic setting within the lagoon.

Three moderately defined ostracode assemblages were found: (1) oyster bank, (2) lagoonal, and (3) washover delta (Figs. 43 and 44). These assemblages roughly correspond to Ayala's foraminiferal biofacies (1963, p. 110).

The ostracode oyster-bank assemblage is found in an area of low salinity, substrate composed of sand low in calcium carbonate and shells *in situ*, depths of less than one fathom, and highly affected by the influx of terrigenous material. This assemblage corresponds to the foraminiferal fluvial biofacies but is restricted to the western portion of the lagoon in Boca de Atasta and vicinity while the foraminiferal fluvial biofacies are found at the mouth of all major tributaries.

Oyster-bank assemblage:

* *Acuticythereis* sp. *B*
* *Cyprideis castus*
** *Cytherura sandbergi*
** *Haplocytheridea bradyi*
** *Megacythere johnsoni*
* *Perissocytheridea bicelliforma*
** *Perissocytheridea brachyforma*
Perissocytheridea excavata
** *Xestoleberis rigbyi*

The lagoonal assemblage is, by far, the most varied and numerous of the three, and encompasses the area occupied by the internal and external foraminiferal lagoonal biofacies. The salinity in this area ranges from 22 to 31‰, sediments from clay to sand, calcium carbonate from 10 to 60% and includes nearly all

* species restricted to one assemblage
** species common to all three assemblages

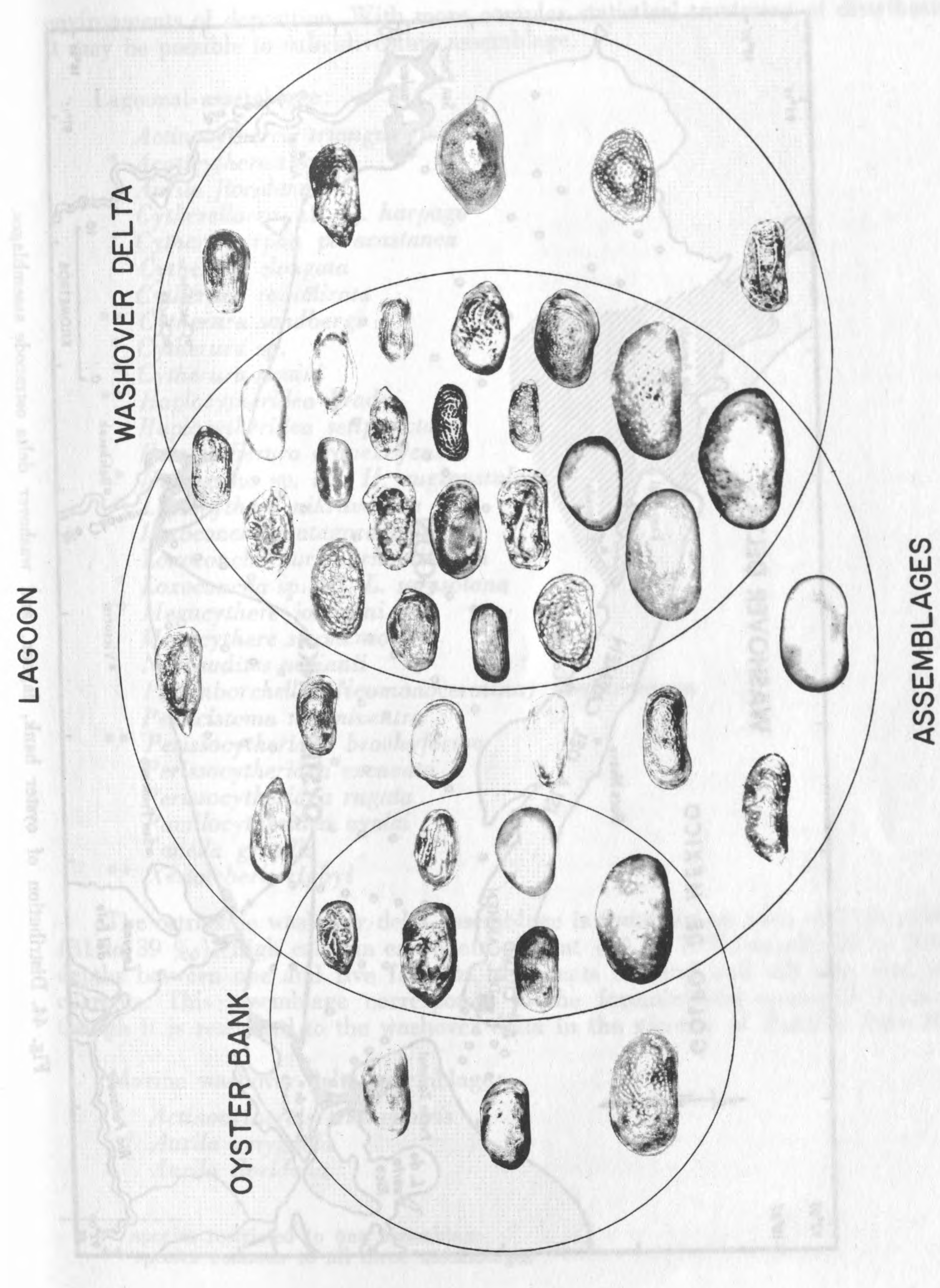

Fig. 43. Ostracoda assemblages in oyster bank, lagoon, and washover delta. Overlapping of circles illustrates species that are characteristic of two environments.

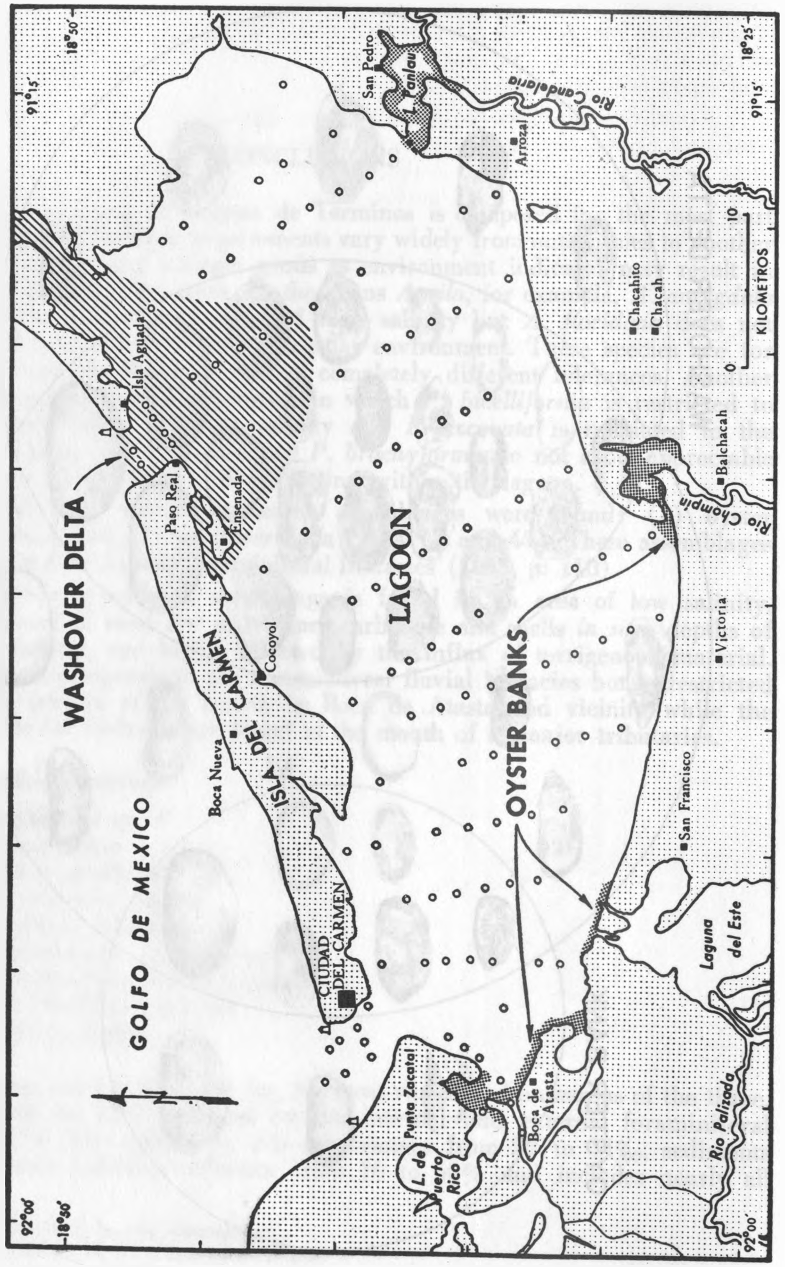

Fig. 44. Distribution of oyster bank, lagoon, and washover delta ostracode assemblages.

environments of deposition. With more complex statistical treatment of distribution it may be possible to subvidive this assemblage.

Lagoonal assemblage:

Actinocythereis triangularis
* *Acuticythereis* sp. *A*
Aurila floridana
* *Cytherella* sp. aff. *C. harpago*
* *Cytheromorpha paracastanea*
Cytherura elongata
Cytherura radialirata
** *Cytherura sandbergi*
* *Cytherura* sp.
* *Cytherura swaini*
** *Haplocytheridea bradyi*
Haplocytheridea setipunctata
Hemicytherura cranekeyensis
* *Hulingsina* sp. aff. *H. rugipustulosa*
* *Leptocythere nikraveshae*
Loxoconcha matagordensis
Loxoconcha purisubrhomboidea
* *Loxoconcha* sp. aff. *L. sarasotana*
** *Megacythere johnsoni*
Megacythere stephensoni
Neocaudites nevianii
Paijenborchella (Neomonoceratina) mediterranea
Pellucistoma magniventra
** *Perissocytheridea brachyforma*
Perissocytheridea excavata
Perissocytheridea rugata
Pumilocytheridea ayalai
Tanella gracilis
** *Xestoleberis rigbyi*

The ostracode washover delta assemblage is found in an area of high salinity (31 to 39 ‰), high calcium carbonate content (20 to 70%, mostly 50 to 70%), depths between one and five fathoms, sediments of sand and silt size, and swift currents. This assemblage corresponds to the foraminiferal open-gulf biofacies, though it is restricted to the washover delta in the vicinity of Boca de Paso Real.

Marine washover delta assemblage:

Actinocythereis triangularis
* *Aurila amygdala*
Aurila floridana

---

* species restricted to one assemblage
** species common to all three assemblages

* *Bairdia bradyi*
Basslerites minutus
Cyprideis mexicana
Cytherura elongata
* *Cytherura* sp. aff. *C. forulata*
Cytherura radialirata
** *Cytherura sandbergi*
** *Haplocytheridea bradyi*
Haplocytheridea setipunctata
Hemicytherura cranekeyensis
Loxoconcha matagordensis
Loxoconcha purisubrhomboidea
** *Megacythere johnsoni*
Megacythere stephensoni
* *Neocaudites nevianii*
* *Orionina bradyi*
Paijenborchella (Neomonoceratina) mediterranea
Pellucistoma magniventra
** *Perissocytheridea brachyforma*
Perissocytheridea rugata
* *Paracytheridea vandenboldi*
Pumilocytheridea ayalai
Tanella gracilis
** *Xestoleberis rigbyi*

The environmental variations in Laguna de Términos are of such magnitude that it would be rather difficult to determine accurately the boundaries of each assemblage. Nevertheless, the assemblages are enclosed as they were found at the time of collection, and it is hoped that the periodic sampling program already under way (Ayala, 1963, p. 120-121) may give a more reliable measure of the migration of ostracodes as well as any possible mixing of the various assemblages found. It is thought that only with a well conducted seasonal sampling program it will be possible to determine which environmental factor or factors have the greatest restricting effect on these organisms (Fig. 45).

From the data now available, the influence of submerged vegetation on ostracode distribution and abundance cannot be evaluated reliably. Approximately half of the ostracodes found in Laguna de Términos are concentrated in the stations fringing the contact of the clear and turbid water. It is perhaps the protection of the submerged plants and the nutrients brought in by the rivers in the western portion of the lagoon which combine to create a most propitious environment for the development of ostracodes (Fig. 46).

Some species are restricted to particular environments of deposition. Isolated specimens are found elsewhere, but these are considered current-distributed. For example, *Hemicytherura cranekeyensis* is concentrated in the washover delta, but

* species restricted to one assemblage
** species common to all three assemblages

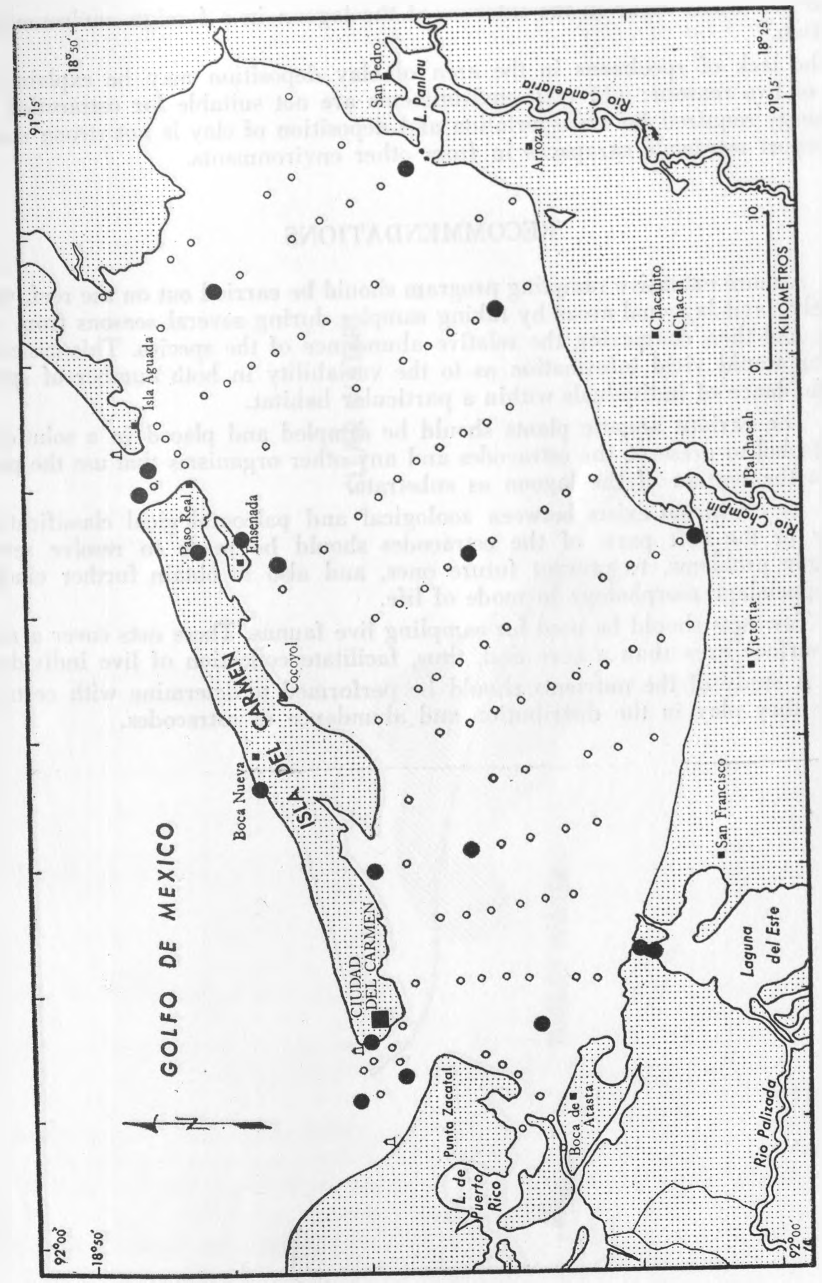

Fig. 45. Location of seasonal collecting stations (larger dots).

isolated specimens 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 clay is not strong enough to transport ostracode carapaces in from other environments.

RECOMMENDATIONS

1. A more extensive sampling program should be carried out on the reef, wash-over delta, and lagoonal areas by taking samples during several seasons from each locality and then comparing the relative abundance of the species. This system of sampling would yield information as to the variability in both number of species and abundance of individuals within a particular habitat.
2. The various aquatic plants should be sampled and placed in a solution of 70% alcohol to preserve the ostracodes and any other organisms that use the plants and not the bottom of the lagoon as substrate.
3. As confusion exists between zoological and paleontological classifications, a study of the soft parts of the ostracodes should be made to resolve several taxonomic problems, to prevent future ones, and also to obtain further clues to relate appendage morphology to mode of life.
4. Tow nets should be used for sampling live faunas. These nets cover a much larger surface area than a core and, thus, facilitate collection of live individuals.
5. A study of the nutrients should be performed to determine with certainty the role they play in the distribution and abundance of ostracodes.

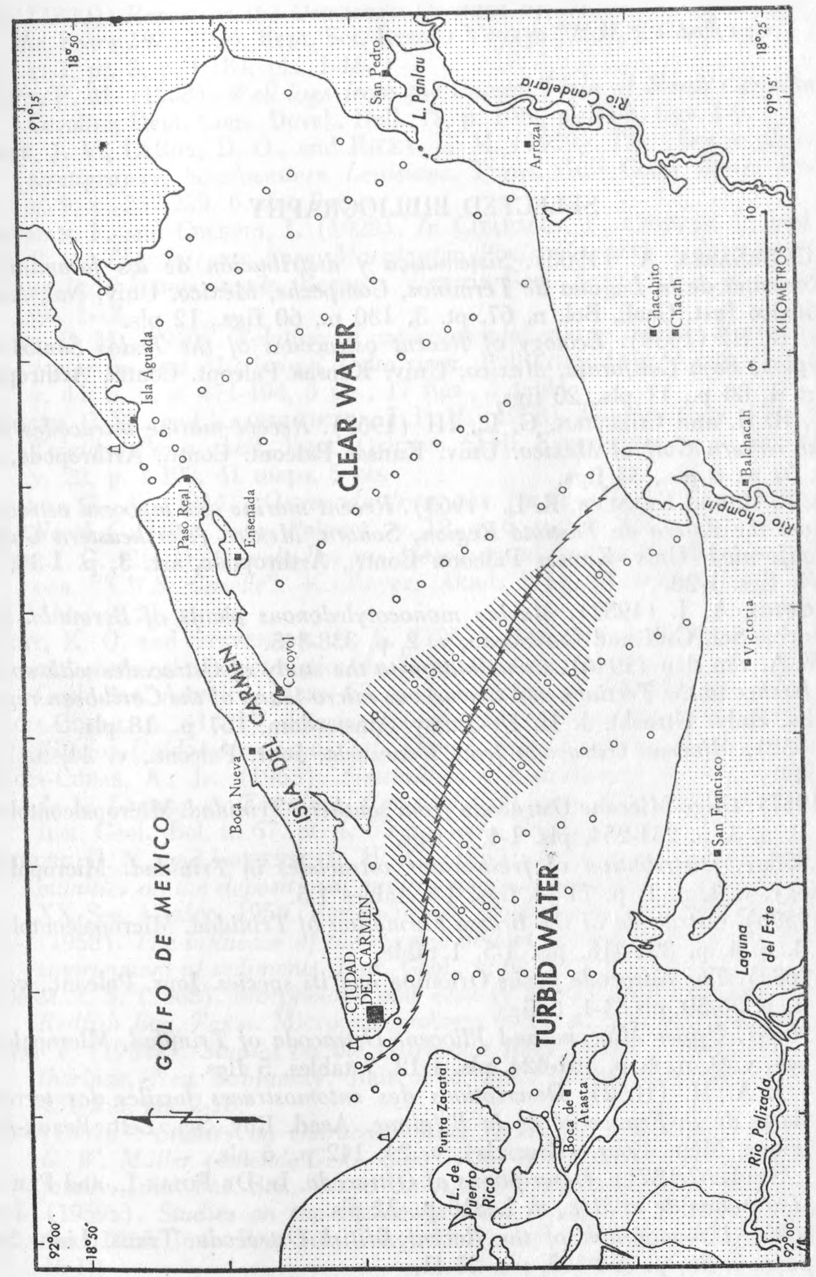

Fig. 46. Area of greatest ostracode concentration in Laguna de Términos

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LAMINAS 1-8

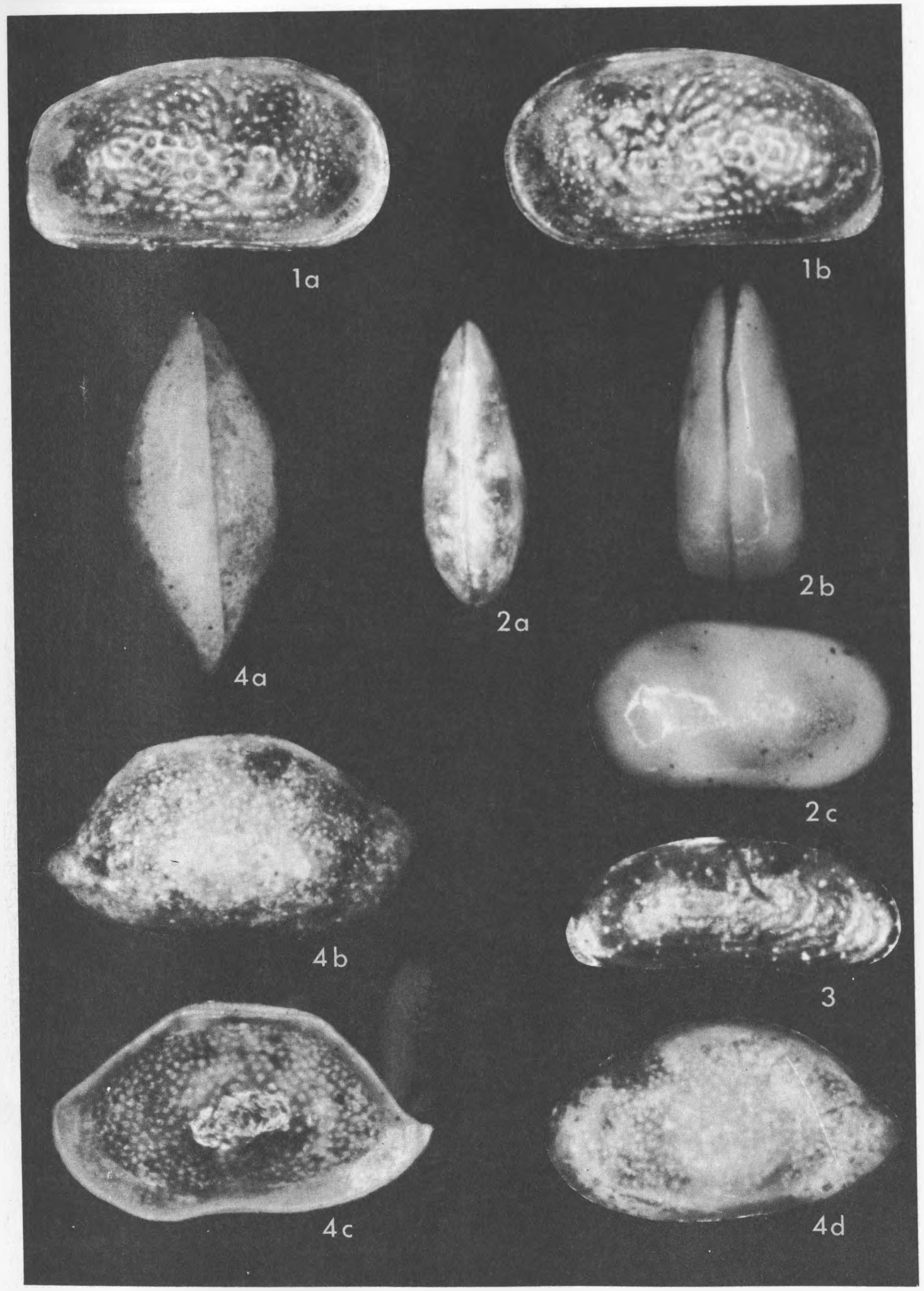
PLATE 1
(All figures × 70)

Figs. 1a-b. *Cyprideis castus* Benson.
1a. Right valve } IGM 2676 Mi.
1b. Left valve }

Figs. 2a-c. *Cytherella* sp. aff. *C. harpago* Kornicker.
2a. Dorsal view, male. IGM 2674 Mi.
2b. Dorsal view, female } IGM 2675 Mi.
2c. Right valve, female }

Fig. 3. *Hulingsina* sp. aff. *H. rugipustulosa* Edwards.
Right valve. IGM 2684 Mi.

Figs. 4a-d. *Bairdia bradyi* van den Bold.
4a. Dorsal view. IGM 2670 Mi.
4b. Right valve. IGM 2671 Mi.
4c. Right valve, interior view. IGM 2672 Mi.
4d. Left valve. IGM 2673 Mi.



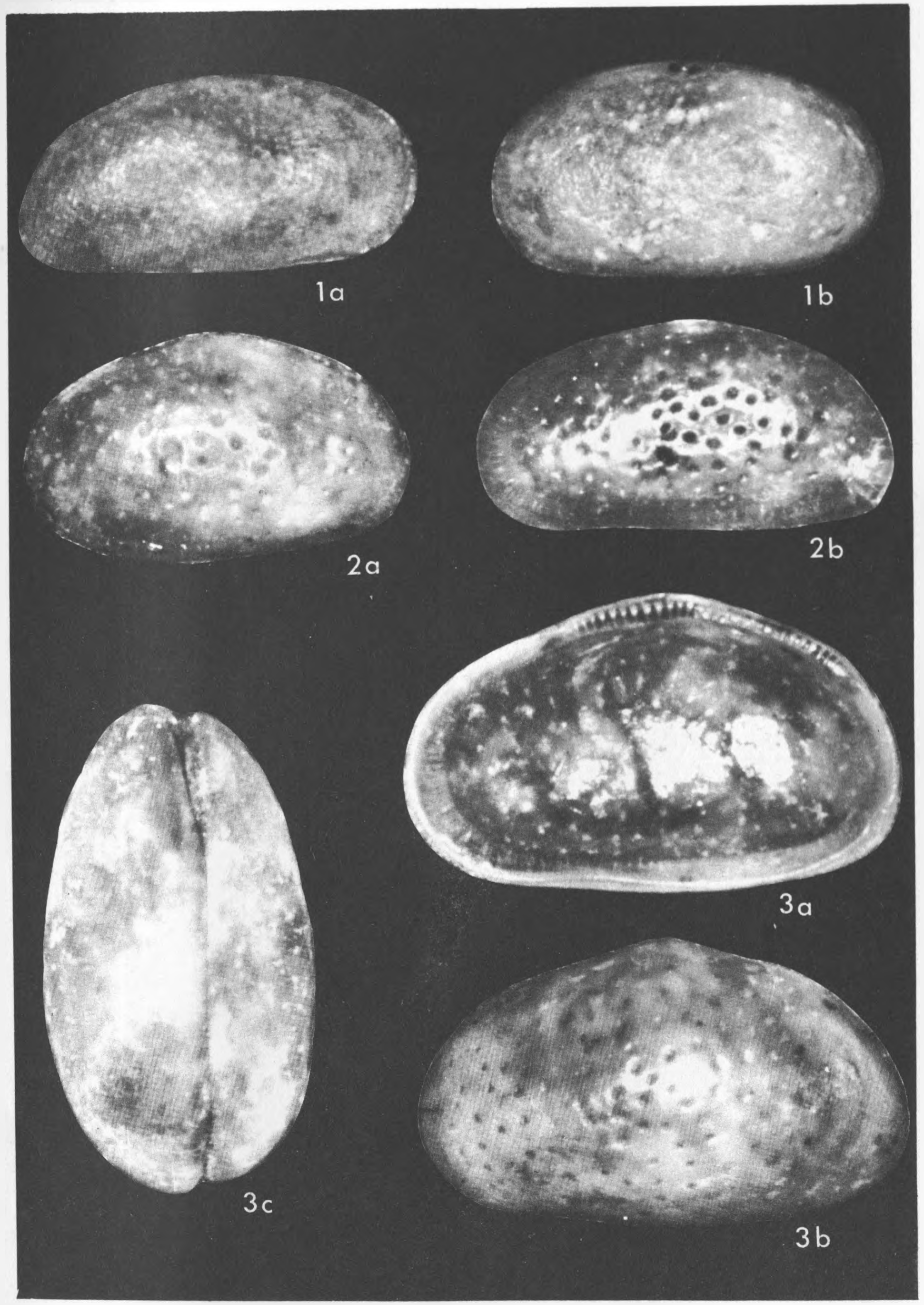
OSTRACODA OF THE LAGUNA DE TERMINOS

PLATE 2
(All figures × 70)

Figs. 1a-b. *Cyprideis mexicana* Sandberg.
1a. Right valve. male. IGM 2677 Mi.
1b. Left valve, female. IGM 2678 Mi.

Figs. 2a-b. *Haplocytheridea bradyi* (Stephenson).
2a. Right valve, female. IGM 2679 Mi.
2b. Left valve, male. IGM 2680 Mi.

Figs. 3a-c. *Haplocytheridea setipunctata* (Brady).
3a. Right valve interior. IGM 2681 Mi.
3b. Left valve. IGM 2682 Mi.
3c. Dorsal view. IGM 2683 Mi.



OSTRACODA OF THE LAGUNA DE TERMINOS

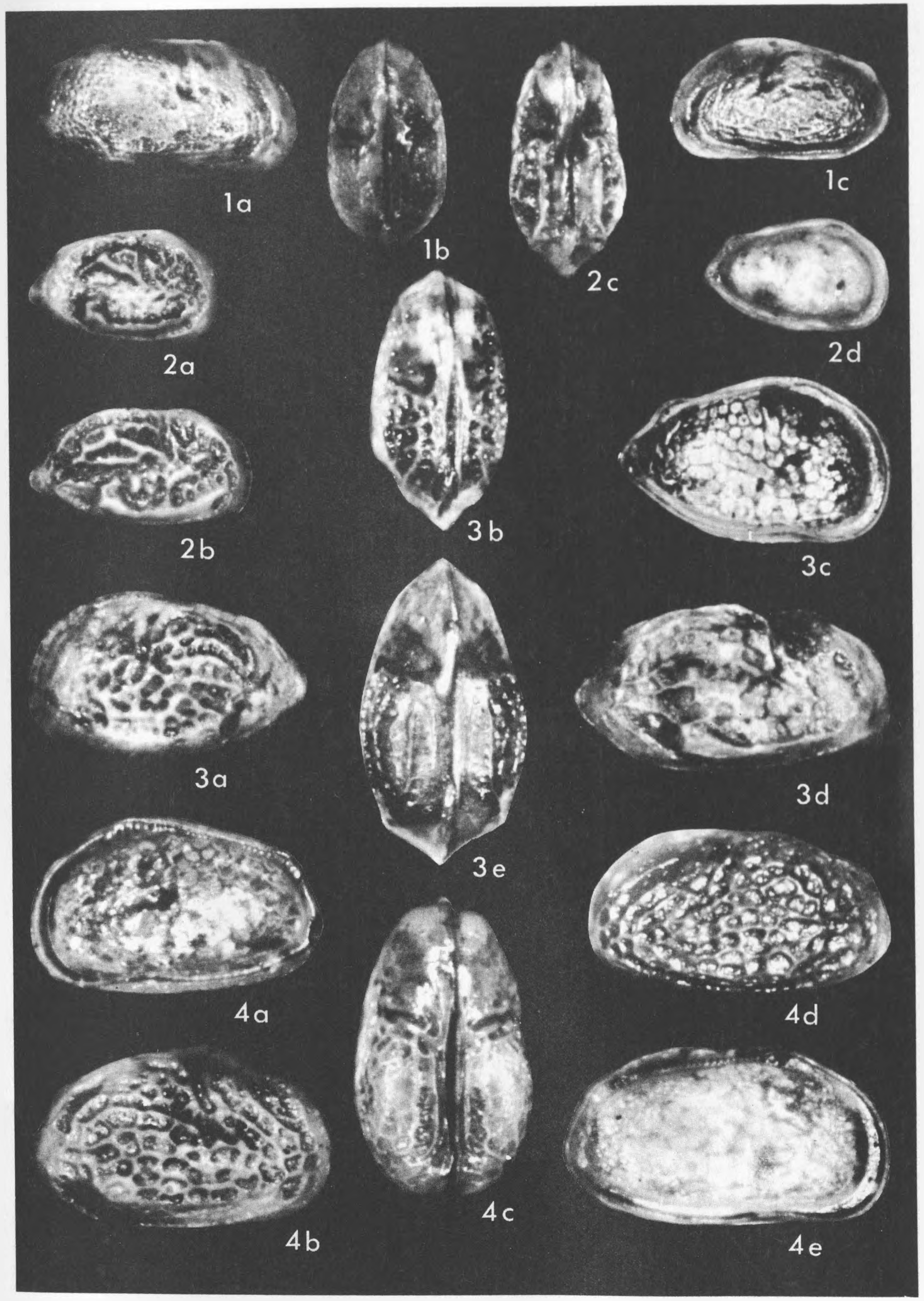
PLATE 3
(All figures × 70)

Figs. 1a-c. *Perissocytheridea bicelliforma* Swain.
1a. Right valve, male. IGM 2685 Mi.
1b. Dorsal view, female. IGM 2686 Mi.
1c. Left valve, female. IGM 2687 Mi.

Figs. 2a-d. *Perissocytheridea excavata* Swain.
2a. Right valve, female. IGM 2688 Mi.
2b. Right valve, male. IGM 2689 Mi.
2c. Dorsal view, male. IGM 2690 Mi.
2d. Left valve, interior, female. IGM 2691 Mi.

Figs. 3a-e. *Perissocytheridea brachyforma* Swain.
3a. Left valve, female. IGM 2692 Mi.
3b. Dorsal view, female. IGM 2693 Mi.
3c. Left valve, interior, female. IGM 2694 Mi.
3d. Right valve, male. IGM 2695 Mi.
3e. Dorsal view, male. IGM 2696 Mi.

Figs. 4a-e. *Perissocyhteridea rugata* Swain.
4a. Right valve, interior, female. IGM 2697 Mi.
4b. Right valve, female. IGM 2698 Mi.
4c. Dorsal view, male. IGM 2699 Mi.
4d. Left valve, male. IGM 2700 Mi.
4e. Left valve, interior, male. IGM 2701 Mi.



OSTRACODA OF THE LAGUNA DE TERMINOS

PLATE 4

Fig. 1 *Cytherura* sp. (× 70)
Left valve. IGM 2702 Mi.

Fig. *Cytherura swaini* van den Bold (× 70).
Right valve. IGM 2703 Mi.

Figs. 3a-c. *Pumylocytheridea ayalai* sp nov. (× 70).
3a. Lef valve. Holotype: IGM 2704 Mi.
3b. Left valve, interior. Paratype: IGM 2705 Mi.
3c. Dorsal view. Paratype :: IGM 2706 Mi.

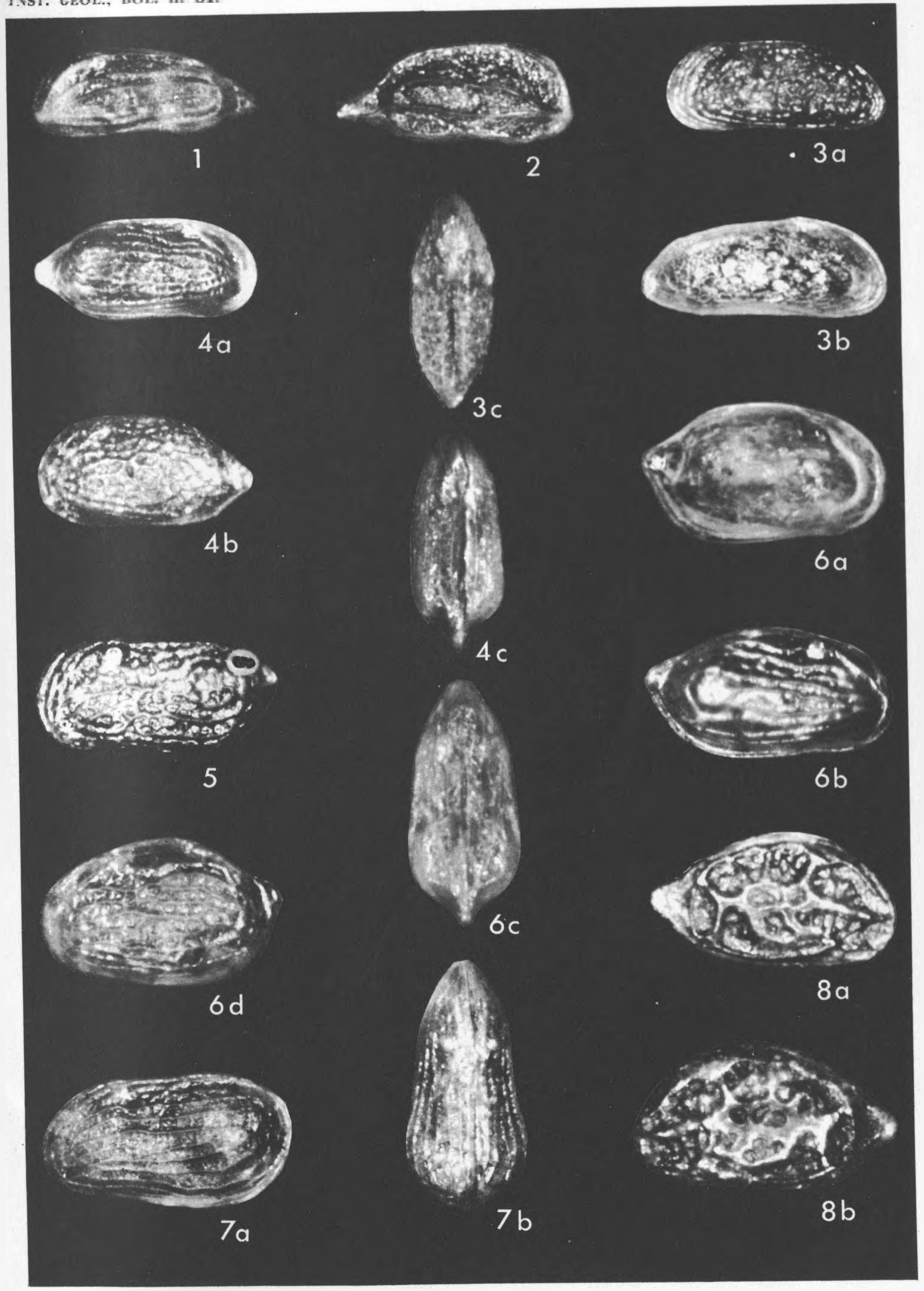
Figs. 4a-c. *Cytherura elongata* Edwards (× 70).
4a. Right valve. IGM 2707 Mi.
4b. Left valve. IGM 2708 Mi.
4c. Dorsal view. IGM 2709 Mi.

Fig. 5 *Cytherura radialirata* Swain (× 70).
Left valve. male. IGM 2710 Mi.

Figs. 6a-d. *Cytherura sandbergi* sp. nov. (× 70).
6a. Left valve, interior, male. Paratype: IGM 2712 Mi.
6b. Right valve, male. Holotype: IGM 2711 Mi.
6c. Dorsal view, male. Paratype: IGM 2713 Mi.
6d. Left valve, male. Paratype: IGM 2714.

Figs. 7a-b. *Cytherura* sp. aff. *C. forulata* Edwards (× 70).
7a. Left valve. }
7b. Dorsal view.} IGM 2715 Mi.

Figs. 8a-b. *Hemicytherura cranekeyensis* Puri (× 105).
8a. Right valve. IGM 2716 Mi.
8b. Left valve. IGM 2717 Mi.



OSTRACODA OF THE LAGUNA DE TERMINOS

PLATE 5

Figs. 1a-b. *Acuticythereis* sp. A (× 70).
1a. Right valve. IGM 2718 Mi.
1b. Left valve, interior. IGM 2719 Mi.

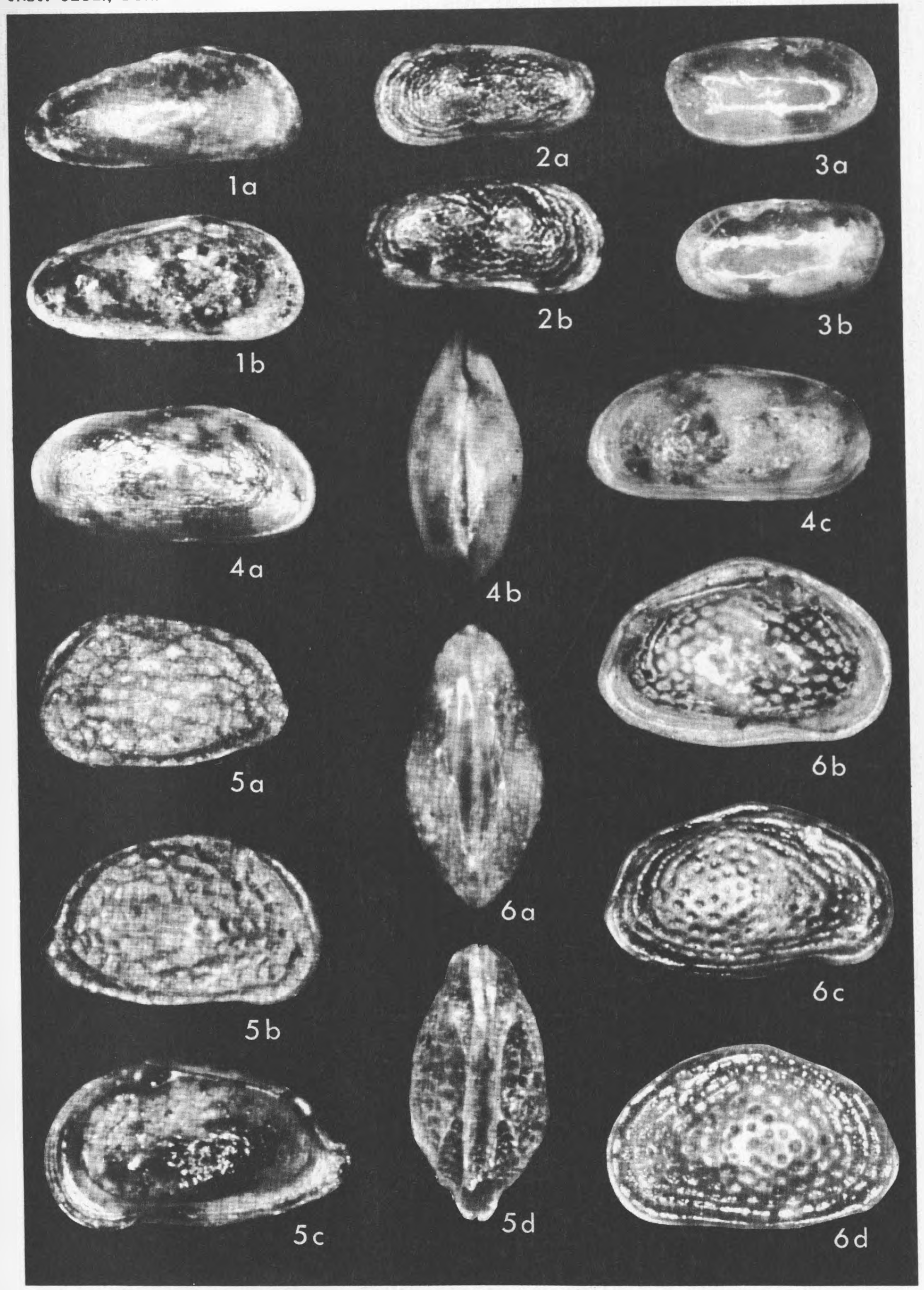
Figs. 2a-b. *Leptocythere nikraveshae* sp. nov. (× 85).
2a. Left valve, female. Paratype: IGM 2720 Mi.
2b. Right valve, male. Holotype: IGM 2721 Mi.

Figs. 3a-b. *Basslerites minutus* van den Bold (× 70).
3a. Right valve } IGM 2722 Mi.
3b. Left valve }

Figs. 4a-c. *Acuticythereis* sp. B (× 70).
4a. Right valve. IGM 2723 Mi.
4b. Dorsal view. IGM 2724 Mi.
4c. Right valve, interior. IGM 2725 Mi.

Figs. 5a-d. *Aurila floridana* Benson and Coleman (× 70).
5a. Left valve, female. IGM 2726 Mi.
5b. Right valve, male. IGM 2727 Mi.
5c. Right valve, interior, male. IGM 2728 Mi.
5d. Dorsal view. IGM 2729 Mi.

Figs. 6a-d. *Aurila amygdala* (Stephenson) (× 70).
6a. Dorsal view. IGM 2730 Mi.
6b. Left valve, interior. IGM 2731 Mi.
6c. Right valve, male. IGM 2732 Mi.
6d. Left valve, female. IGM 2733 Mi.



OSTRACODA OF THE LAGUNA DE TERMINOS

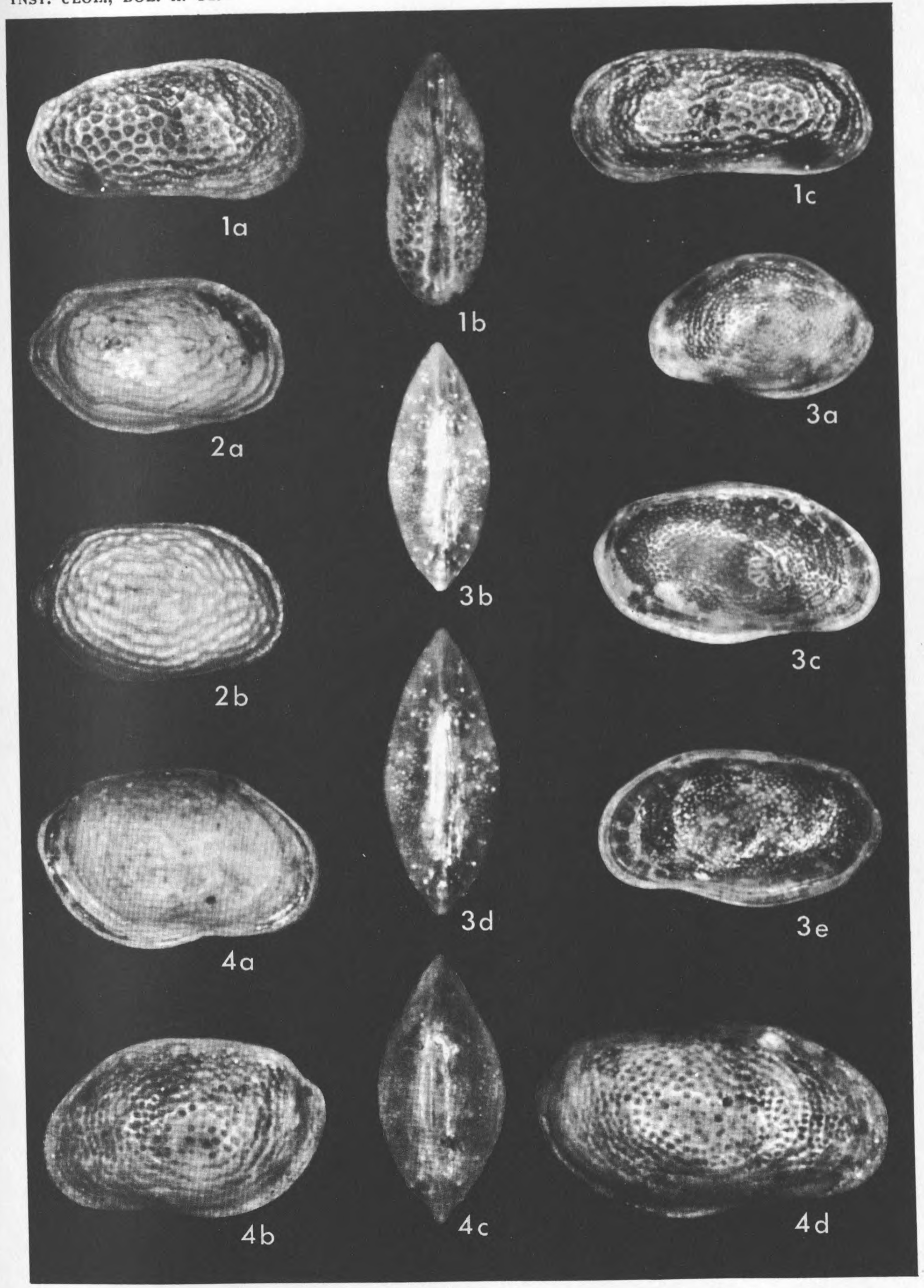
PLATE 6
(All figures × 70)

Figs. 1a-c. *Cytheromorpha paracastanea* (Swain)
1a. Right valve, female. IGM 2734 Mi.
1b. Dorsal view. IGM 2735 Mi.
1c. Left valve, male. IGM 2736 Mi

Figs. 2a-b. *Loxoconcha* sp. aff. *L. sarasotana* Benson and Coleman.
2a. Left valve, interior, female. IGM 2737 Mi.
2b. Right valve, female. IGM 2738 Mi.

Figs. 3a-e. *Loxoconcha purisubrhomboidea* Edwards
3a. Left valve, female. IGM 2739 Mi.
3b. Dorsal view, female. IGM 2740 Mi.
3c. Right valve, male. IGM 2741 Mi.
3d. Dorsal view, male. IGM 2742 Mi.
3e. Right valve, interior, male. IGM 2743 Mi.

Figs. 4a-d. *Loxoconcha matagordensis* Swain.
4a. Left valve, interior, female. IGM 2744 Mi.
4b. Left valve, female. IGM 2745 Mi.
4c. Dorsal view, female. IGM 2746 Mi.
4d. Right valve, male. IGM 2747 Mi.



OSTRACODA OF THE LAGUNA DE TERMINOS

PLATE 7
(All figures × 70)

Figs. 1a-c. *Tanella gracilis* Kingma
1a. Right valve, interior. IGM 2748 Mi.
1b. Dorsal view. IGM 2749 Mi.
1c. Left valve. IGM 2750 Mi.

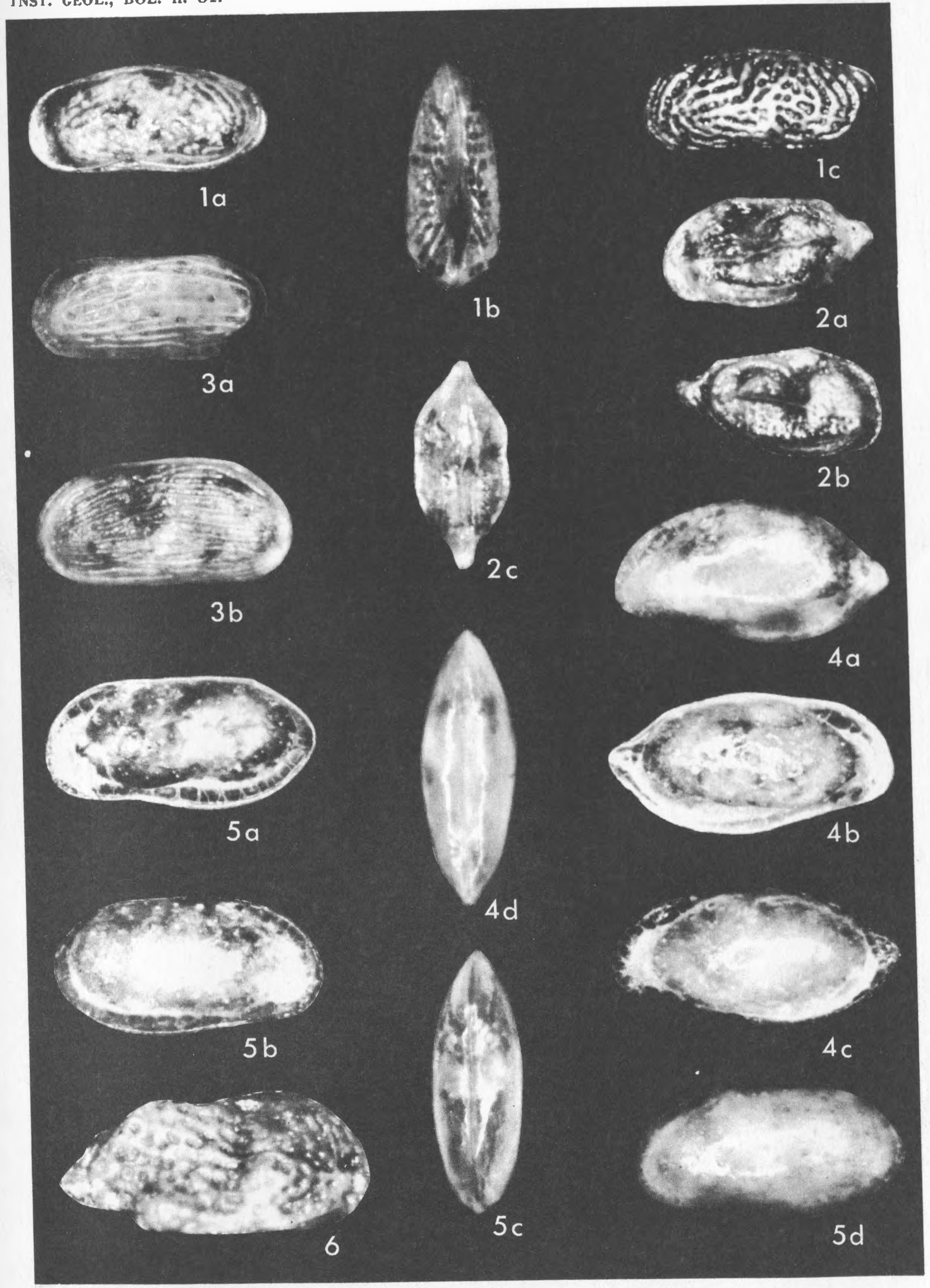
Figs. 2a-c. *Paijenborchella (Neomonoceratina) mediterranea* Ruggieri
2a. Left valve. IGM 2753 Mi.
2b. Right valve. IGM 2754 Mi.
2c. Dorsal view. IGM 2755 Mi.

Figs. 3a-b. *Megacythere johnsoni* (Mincher)
3a. Left valve. IGM 2751 Mi.
3b. Left valve. IGM 2752 Mi.

Figs. 4a-d. *Pellucistoma magniventra* Edwards
4a. Left valve. IGM 2756 Mi.
4b. Left valve, interior. IGM 2757 Mi.
4c. Left valve. IGM 2758 Mi.
4d. Dorsal view. IGM 2759 Mi.

Figs. 5a-d. *Megacythere stephensoni* Puri
5a. Right valve, interior. IGM 2760 Mi.
5b. Right valve. IGM 2761 Mi.
5c. Dorsal view. IGM 2762 Mi.
5d. Left valve. IGM 2763 Mi.

Fig. 6. *Paracytheridea vandenboldi* Puri.
Right valve. IGM 2764 Mi.



OSTRACODA OF THE LAGUNA DE TERMINOS

PLATE 8
(All figures × 70)

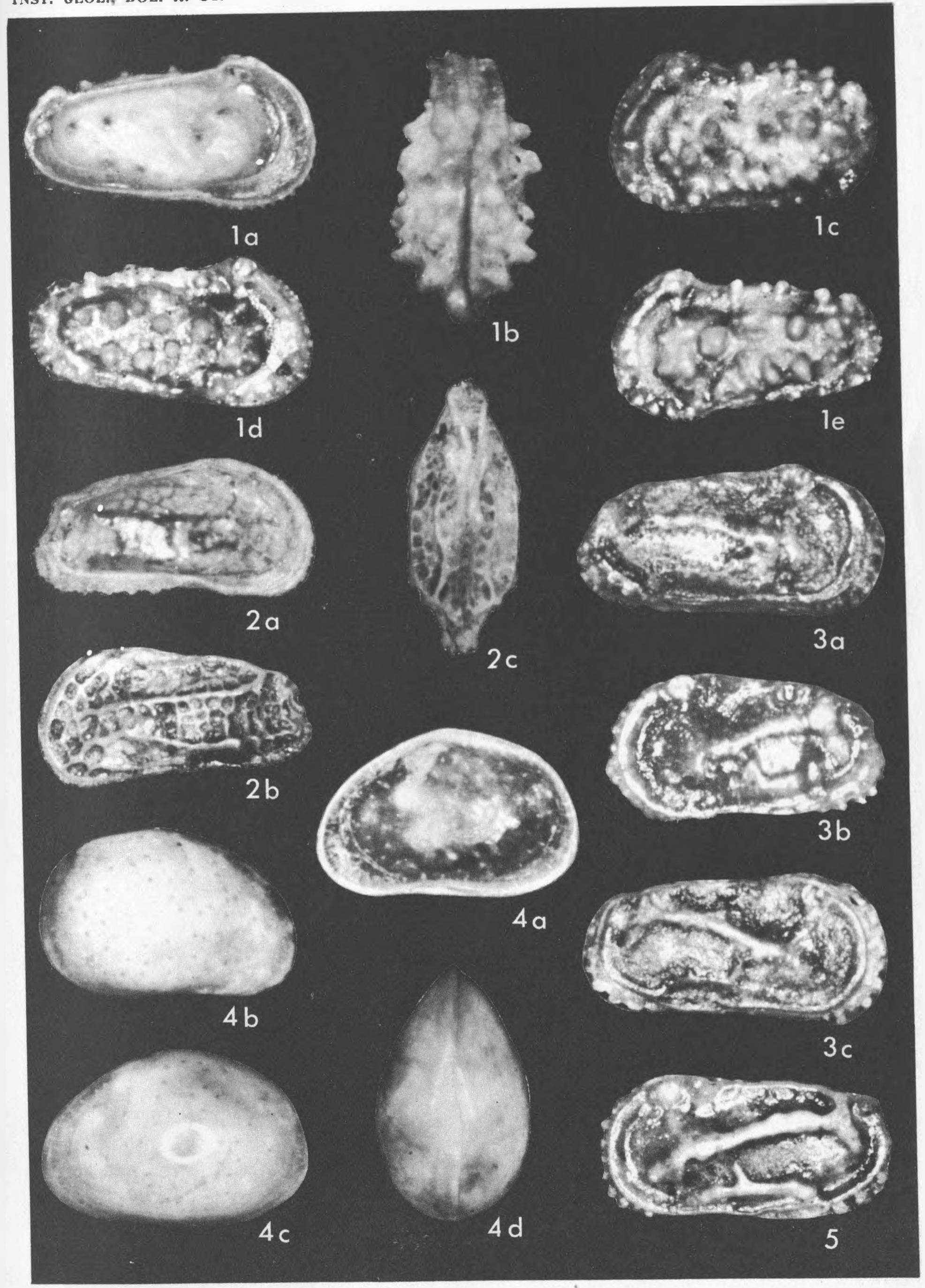
Figs. 1a-e. *Actinocythereis triangularis* sp. nov.
1a. Left valve, interior, male. Paratype: IGM 2766 Mi.
1b. Dorsal view. Paratype: IGM 2767 Mi.
1c. Left valve, female. Paratype: IGM 2768 Mi.
1d. Right valve, male. Paratype: IGM 2769 Mi.
1e. Left valve. male. Holotype: IGM 2770 Mi.

Figs. 2a-c. *Orionina bradyi* van den Bold
2a. Left valve, interior. IGM 2771 Mi.
2b. Left valve. } IGM 2772 Mi.
2c. Dorsal view.}

Figs. 3a-c. *Neocaudites nevianii* Puri.
3a. Right valve, male. IGM 2773 Mi.
3b. Left valve, female. IGM 2774 Mi.
3c. Right valve, male. IGM 2775 Mi.

Figs. 4a-d. *Xestoleberis rigbyi* sp. nov.
4a. Right valve, interior. Paratype: IGM 2776 Mi.
4b. Right valve. Paratype: IGM 2777 Mi.
4c. Left valve. Holotype: IGM 2779 Mi.
4d. Dorsal view. Paratype: IGM 2778 Mi.

Fig. 5. *Neocaudites triplistriatus* (Edwards)
Left valve, male. IGM 2780 Mi.



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Se terminó de imprimir el día 31 de diciembre de 1966 en la Imprenta Nuevo Mundo, S. A., Calzada del Moral 396, Ixtapalapa, México 13, D. F. La edición consta de 1,200 ejemplares.

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