I. ABSTRACT

Twenty-four species of ostracodes are recorded from the Simore, Tuy and Cumaca formations of the State of Miranda and from the Guiria Formation of the State of Sucre. Three new species are described: Cytheridea? purperae, Callistocythere? macsotaaji and Xestoleberis bermudezi. The lower Simore Formation is correlated with the lowermost unit (Unit J) of the Guiria Formation and with the Caparo clay member of the Talparo Formation of Trinidad (Pliocene). The upper Simore Formation is correlated with the upper Talparo Formation, and the Tuy Formation and Unit E of the Guiria Formation are tentatively assigned to the Pleistocene.

II. INTRODUCTION

One of the frustrating problems for a paleontologist is the dating of Cenozoic fresh or brackish water deposits. They often contain only endemic, and specialized, environmentally controlled faunas. They are usually not overlain by datable younger sediments and often overlie much older deposits unconformably. Within the Caribbean Region there are several examples, including in Venezuela, the Simore, Cumaca and Tuy Formations of Miranda (Picard and Pimentel, 1968), and the Guiria Formation of Sucre (Macsotay, 1976); and in Hispaniola, the Jimani Formation of the Hoya de Enriquillo and its equivalents in the Cul-de-Sac continuation (Bold, 1975). In Brasil, Ivone Purper (1977, 1979) encountered a similar situation with the Pebas Formation of the upper Amazon basin, as did Sheppard and Bate (1980) in...
Colombia and Peru. In Colombia I have found the dating of the so-called "Chara-zone" in the upper Magdalena Valley of the department of Huila equally difficult.

Additional problems may occur when foraminifer and ostracode-rich unconsolidated sediments are reworked into lacustrine environment, where the fauna consists of very thin-shelled and fragile species, which are destroyed in sample preparation. I recently encountered this in the Neogene of the Camp Perrin Basin of southern Haiti, where the fresh water ostracodes disintegrate completely on washing so that the residue contains only well preserved (but reworked) marine forms. A similar situation is present in the Llanos region of Ecuador where Cretaceous planktonic foraminifera have been re-deposited in Tertiary fresh and brackish water sediments (Tschopp, 1953). The result of all this is that specialists on different groups of fossils will inevitably come to totally different conclusions about the age and environment of such sediments.

The purpose of this paper is to discuss the biostratigraphic distribution of the ostracodes of the Sigure, Cumaca, Tuy and Guiria formations and their relations to faunas from Trinidad and Hispaniola. The results of the study are at variance with previous paleontological interpretations.

III. ACKNOWLEDGMENTS

I am indebted to Christian Beck (University of Lille, France) and Oliver Macsotay (Universidad de Oriente, Cumana, Venezuela) for providing the samples on which this study is based. I dedicate this paper to the late Pedro Bermúdez, who also contributed material. I wish to thank R. M. Forester for the numerous notations made in reviewing the manuscript; I have followed many of his suggestions.

IV. MATERIAL STUDIED

BASIN OF SANTA LUCIA - OCUMARE DEL TUY

In this basin (Estado Miranda) two formations are present, which have yielded a small number of fresh and brackish water ostracodes. The Sigure Formation unconformably overlies metamorphic rocks and underlies the Tuy Formation with local unconformity (Picard and Pimentel, 1968). Dr. C. Beck (University of Lille, France) sent me samples of the Sigure Formation, which were taken along a section about 2 km long, running from about 1 km south of Sta. Teresa to the north-northwest (Text-Fig. 1). From the late Dr. P. J. Bermúdez I received a sample from the Tuy Formation (Picard and Pimentel, 1968, p. 284). Dr. Bermúdez also furnished a sample of the Cumaca Formation, which is the supposed equivalent of the Sigure Formation in the Lower Tuy-Barlovento basin (Picard and Pimentel, 1968).

In the Sigure Formation (Table 1) the most common ostracodes are species of *Darwinula* and *Limnocythere*, usually characteristic of ephemeral or permanent lakes. Many of the freshwater ostracodes are represented only by casts with occasionally adherent parts of shell material; thus, generic determinations are somewhat uncertain and specific determinations unreliable. Only two samples show a more diverse fauna which, in addition to fresh water forms, also contains some (probably) brackish water *Cytheracea*. It is especially in these samples that shell material is slightly thicker and, therefore, partly or even completely preserved.

In the lower part of the Sigure Formation (Samples 858-886) the fauna is dominated by *Limnocythere* sp. 1 and 3. Sample 885 yielded *Darwinula* sp. aff. *D. olivenae* Purper, *Pseudocandona*? sp. and *Limnocythere* sp. 3, as well as *Cytheridea? rohri* (Bold, 1963), which is known from the Talparo Formation of Trinidad and the Guiria Formation of the Paria peninsula (Bold in Macsotay, 1968, p. 64; Bold, 1972, Table 2).

The upper part of the Sigure Formation (samples 890-952) is characterized by *Limnocythere* sp. 2. Sample 898 contains, in addition to *Stenocypris*? sp. and *Heterocypris*? sp., also *Cytheridella boldi* Purper, *Cytheridea? rohri* (Bold) and *Cytheridea? purperae* n. sp. Conspicuous in this sample is the absence of *Darwinula* and *Limnocythere*, which suggests an interruption of lacustrine deposition by a brackish water invasion. *Cytheridella boldi* is living in Lago de Valencia (Text-fig. 1), and has been found as a fossil in the Jimani Formation of Hispaniola (Bold, 1975) and in the upper part of the Talparo Formation of
Trinidad (M. Dempsey, Texaco Trinidad, letter and material, 1972).

Bermúdez' sample (VB-2) from the Cumaca Formation (Bold, 1972, p. 1012) only contains *Limnocythere staplini*.

Gutentag and Benson (1962), originally described from the Pleistocene of Kansas and subsequently reported from the upper Las Salinas Formation and the Jimani Formation of Hispaniola (Bold, 1975), late

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Text-fig. 1. Map of the study area.
Pliocene or Pleistocene in age. In North America this species is found in lakes in which the water is enriched in Na, Mg, Ca, SO2, and Cl, and depleted in HCO3 (Forester, 1983), which suggests that similar conditions may have been present in the Cumaca lake(s).


The fauna of the lower “brackish water” intercalation of the Squire Formation (885) correlates well with the brackish-marine lower part of the Guiria Formation (Unit J of Macsotay, 1968, p. 55) and the brackish water parts of the Talparo Formation (Table 1). The upper “brackish water” intercalation (898) is somewhat similar in fauna to the upper part of the Guiria Formation (Unit E of Macsotay, 1968, p. 56), which lacks, however, Cytheridea rohri, and to the fresh water upper part of the Talparo Formation. According to this evidence the Squire Formation should be of late Pliocene age. This is in complete disagreement with other investigators, who assigned it an early to middle Miocene age (Picard and Pimentel, 1968; Macsotay, 1968). The Tuy Formation (also without Cytheridea rohri) could be contemporaneous with the upper part of the Guiria Formation and of late Pliocene to early Pleistocene age. This is still much younger than Macsotay’s conclusion of a late Miocene to Pliocene age.

PARIA PENINSULA

From the Guiria Formation (State of Sucre) I have only two samples that yielded ostracodes. One (496a), collected by Bermúdez from the base of Macsotay’s Unit J, 4-5 m above the base of the formation (Macsotay, 1968, p. 56), contains Cyprideis similis (Brady), Cytheridea? rohri (Bold), Perissocytheridea subrugosa (Brady), P. cytheridelliformis Forester, Catiella pulleyi Teeter, Bassleriites minutus Bold, Loxoconcha levis Brady, Callistocythere? macsotayi n. sp., and Xestoleberis bermudezi n. sp. The Catiella and Bassleriites species are marine forms with a fairly long stratigraphic range in the Neogene. Cytheridea? rohri occurs in the Caparo and Chin-Chin clay members of the Talparo Formation. Perissocytheridea subrugosa is known from Pliocene to Recent in the Greater Antilles and Trinidad, whereas the other brackish water species P. cytheridelliformis has been found so far only in the upper Las Salinas Formation of Hispaniola (Cyprideis salebrosa zone, late Pliocene - Recent). Cyprideis similis has the same range as C. salebrosa. Loxoconcha levis is known from Pliocene to Recent brackish water deposits in the Caribbean; it occurs throughout the Talparo Formation, except the Sum-Sum sand member (Table 1).

In the Caribbean the brackish water Pliocene can be subdivided into a late and early division on the basis of the presence or absence of Cyprideis salebrosa and C. similis. The boundary should lie close to that of the zones N 18 and N 19 of the planktonic foraminiferal zonation (Bold, 1983). In this scheme the upper Las Salinas Formation and most of the Talparo Formation, as well as the lower part of the Guiria Formation belong to the late Pliocene. Macsotay (1968), in contrast, places all of the Guiria Formation in the Pleistocene. The regional and local brackish water ostracode zonation of the Pliocene of Trinidad is shown in Text-fig. 2, which is based on Bold (1963), with additions by M. Dempsey (Texaco Trinidad, Company report, 1972). Here also the position of the C.? rohri zone is indicated.

The other sample was collected by Macsotay from his Unit E (42-45 m above the base of the Guiria Formation) and contains a fresh water fauna (except for the inclu-
<table>
<thead>
<tr>
<th>Los Salinas</th>
<th>Jimani</th>
<th>Pebas</th>
<th>Durham</th>
<th>Chin Chin</th>
<th>Caparo</th>
<th>Sum Sum</th>
<th>Guiria E</th>
<th>Tay</th>
<th>Cumaca</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

Darwinula sp. aff. D. fragilis Purper
Ilyocypris sp.
Stenocypris? sp.
Heterocypris? sp.
Conchonula sp. 1
Ostracode sp.
Limnocythere sp. 1
Limnocythere sp. 2
Limnocythere sp. 3
Limnocythere sp. 4
Limnocythere staplini Gutentag and Benson
Cytheridella boldi Purper
Cytheridea rohri (Bold)
Cytheridea purperae n. sp.
Cypria aequalica Sheppard and Bate
Potamocypris sp.
Perissocytheridea cytheridellaformis Forester
Perissocytheridea subrugosa (Brady)
Cyprideis similis (Brady)
Calloocythere? macrostaiyi n. sp.
Cathecia pulleyi Teeter
Basslerites minutus Bold
Loxoconcha levis Brady
Xestoleberis bermudezi n. sp.
The position of the Cytheridea? rohri zone in Trinidad (Text-fig. 2) in the late Pliocene puts some restrictions on the stratigraphic position of Unit J of the Guiria Formation and the whole of the Siquire Formation. The fact that C? rohri and C? purperae occur together in the Upper Siquire Formation may indicate that this part of the formation is slightly older than Unit E of the Guiria Formation, where only the latter species is found. Unit E may be more or less contemporaneous with the Tuy Formation. However, we know very little about environmental preferences of C? purperae and its upper Amazon relatives. It may conceivably have lived in an almost pure fresh water environment and thereby have been a tropical equivalent of the boreal form Cytherissa lacustris (Sars). Such forms have not been found in Recent tropical pools and lakes, but they may have enjoyed a brief period of development during the late Neogene time of climatic deterioration.

Therefore, it is quite possible that C? rohri is eliminated in low salinities that were tolerated by C? purperae in the upper part of the Guiria Formation, whereas in the Talparo Formation salinity may have been excessive for C? purperae. However, if we assume that the two species are indicative of more or less the same degree of salinity (after all, they do occur together in the same sample) and that, therefore, their presence or absence is stratigraphically significant, a tentative correlation between the Northern basin of Trinidad, the Paria Peninsula and the Sta. Lucia-Ocumare del Tuy basin, as shown in Text-fig. 3, would appear plausible.

V. DISCUSSION

The position of the Cytheridea? purperae zone in Trinidad (Text-fig. 2) in the late Pliocene puts some restrictions on the stratigraphic position of Unit J of the Guiria Formation and the whole of the Siquire Formation. Tentative age assignments of the Pebas Formation generally agree on a late Pliocene to Pleistocene age (Purper, 1979, Sheppard and Bate, 1980). Cytheridea? purperae is known from the Siquire and Tuy Formation and is probably closely related to species from the upper Amazon basin (see Systematic Descriptions).

VI. SYSTEMATIC DESCRIPTIONS

Types and illustrated specimens have been deposited in the H. V. Howe collections, Louisiana State University, Baton Rouge: HVH nos. 10750-10789.

Subclass OSTRACODA Latreille, 1806
Order PODOCOPIDA Muller, 1894
Suborder PODOCOPINA Sars, 1866
Superfamily DARWINULACEA Brady and Norman, 1889
Family DARWINULIDAE Brady and Norman, 1889
Genus DARWINULA Brady and Robertson, 1885
DARWINULA sp. aff. D. olivencae Purper
Plate 1, fig. 1

Darwinula sp. PURPER, 1977, p. 364, pl. 4, figs. 5-8.
Darwinula fragilis PURPER, 1979, p. 225, pl. 1, figs. 4-10 (not Schneider, 1948).
Darwinula sp. SHEPPARD and BATE, 1980, p. 117, pl. 13, fig. a 7.

<table>
<thead>
<tr>
<th>Regional zonation</th>
<th>Local zonation</th>
<th>Members</th>
<th>Formations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleistocene</td>
<td>Propriocycris cantarensis</td>
<td>Cytheridea rohri</td>
<td>Talparo</td>
</tr>
<tr>
<td>Miocene</td>
<td>Cytheridea kalmanni</td>
<td>Cytheridea mediatena</td>
<td>Springvale</td>
</tr>
<tr>
<td>Miocene</td>
<td>Cypriidea salebrosa</td>
<td>Cytheridea rohri</td>
<td>Manzanilla</td>
</tr>
<tr>
<td>Pliocene</td>
<td>Chir Chir clay</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Text-fig. 2. Regional and local ostracode zonation, Formations and Members of the Upper Miocene to Pleistocene in the Northern Basin of Trinidad.
Text-fig. 3. Correlation of Plio-Pleistocene formations of the Sta. Lucia-Ocumare del Tuy basin, the Paria Peninsula and the Northern Basin of Trinidad. Presence of Cytheridea? rohri, Cytheridea? purperae and Cytheridella boldi is indicated.

Darwinula olivenciae PURPER, 1984, p. 1371.

Dimensions: Female Left valve: L 0.54 mm, H 0.23 mm; right valve: L 0.53 mm, H 0.24 mm. Male right valve: L 0.55 mm, H 0.24 mm.

Distribution: Tuy, Siquire, and upper Guiria formations.

Remarks: The specimens are identical in outline to Darwinula sp. from the Pebas Formation of Peru, but very slightly larger. They are a bit less slender than Purper’s species from the Pebas Formation of Brazil, but appear to have the same outline. In view of the great similarity between all Darwinula species, its identity cannot be proven.
Subfamily HERPETOCYPRIDIDAE
Kaufmann, 1900

Genus STENOCYPRIS Sara, 1899
STENOCYPRIS? sp.
Plate 1, fig. 2

Description: Carapace in side view elongate, highest at 3/8 of the length from the anterior extremity. Anterior margin evenly rounded in lower 2/3 with long, straight dorsal slope; dorsal margin straight, converging posteriorly towards the sinuate ventral margin; posterior margin narrowly rounded subventrally, obliquely truncate above. Dorsal view pod-shaped, widest in the middle, ends acuminate.

Dimensions: L 1.18 mm, H 0.53 mm, W 0.38 mm. The larger specimens are accompanied by internal casts of smaller dimensions of about the same shape, probably juveniles: L 0.88 mm, H 0.40 mm; L 0.74 mm, H 0.34 mm. It is uncertain if the larger specimens are adults.

Distribution: Upper Squire Formation.

Remarks: As the marginal area could not be studied in the present material, the assignment to Stenocypris is based on external morphology only. Stenocypris major (Baird) (see Triebel, 1953, pl. 1, fig. 1-6; pl. 2, fig. 7-14) is larger, has parallel dorsal and ventral margins and a less steeply truncate posterdorsal margin.

Family CYPRIDOPSIDAE
Kaufmann, 1900

Genus POTAMOCYPRIS Brady, 1870
POTAMOCYPRIS sp.
Plate 1, fig. 6

Description: Carapace triangular in side view, highest at about 1/3 of the length from the anterior extremity. Anterior margin obliquely rounded; dorsal margin gently convex, sloping down from the greatest height and continuing into the more steeply sloping posterior margin, which is narrowly rounded ventrally; ventral margin sinuate.

Dimensions: L 0.55 mm, H 0.29 mm.

Distribution: Upper Guiria Formation (Unit E).

Remarks: This form shows similarity with P. schubarti Klie (1940, p. 65, figs. 11-19) from northeastern Brasil, but has the greatest height more anteriorly located. It is ventrally less concave and posterdorsally less angulate than P. sp. aff. P. schubarti (Bold, 1976, table 9) from Lago de Valencia, Recent, Venezuela.

Family ILYOCYPRIDIDAE
Kaufmann, 1900
Genus ILYOCYPRIS Brady and Norman, 1889
ILYOCYPRIS sp.
Plate 1, fig. 4

Description: Carapace large, subelliptical to rectangular. Anterior end evenly rounded, dorsal and ventral margin almost straight and parallel, posterior end slightly obliquely rounded. Surface finely pitted. Two sulci extend from the

PLATE 1

Figures
1. Darwinula sp. aff. D. fragilis Purper, HVH 10780, right valve view. loc. CB 77-885. Squire Formation. 90 X.
2. Stenocypris? sp., HVH 10782, right valve view, loc. CB 77-898, Squire Formation. 40 X.
3. Cypry aequalica Sheppard and Bate, HVH 10781, right valve, Unit E, Guiria Formation. 90 X.
4. Ilyocypris sp., HVH 10785, left valve view, loc. CB 77-898, Squire Formation. 30 X.
5. Heterocypris sp., HVH 10784, right valve view, loc. CB 77-898, Siquier Formation. 60 X.
6. Potamocypris sp., HVH 10783, right valve view, Unit E, Guiria Formation. 150 X.
7-11. Cytheridea purpeme n. sp., loc. VB-1, Tuy Formation. 50X. 7, HVH 10755, holotype, right valve, female; 8, HVH 10756, left valve, female; 9, HVH 10757, dorsal view, female; HVH 10758, left valve, male; 11, HVH 10759, right valve, male.
12. Pacamboycythere campana (Sheppard and Bate), HVH 10771, right valve view, female, loc. Ka 1161 "Chara Zone," Huila, Colombia. 85 X.
13-14. Perissocytheridea subrugosa (Brady), HVH 10770, Unit J. Guiria Formation. 85 X.
13, Dorsal view, female; 14, dorsal view, male.
dorsal margin slightly obliquely downward and backward to just above median height, one at 2/5 of the length from the anterior extremity, the other centrally located. Adductor muscle scars situated below and slightly in front of the central sulcus. Left valve slightly overlapping the right along dorsal margin, right valve slightly overlapping in the posterior end. Dorsal view lanceolate, widest at about 1/4 of the length from the posterior extremity.

**Dimensions:** L 1.35 mm, H 0.78 mm, W 0.55 mm.

**Distribution:** Only sample 898, Siquire Formation (common, but all specimens damaged).

**Superfamily CYTHERACEA Baird, 1850**

**Family CYTHERIDAE Sars, 1925**

**Genus CYTHERIDEA? RoHri Bosquet, 1852**

_Cytheridea? rohri_ (Bold)

Plate 3, figs. 1-7

*Cyprideis rohri* BOLD, 1963, p. 378, pl. 2, figs. 4a, b; pl. 3, figs. 1-9; pl. 11, fig. 4; table 5 (part).

_Cytheridea rohri_ (Bold), SANDBERG, 1964, p. 168, pl. 13, fig. 8; BOLD in MACSOTAY, 1968, p. 64; BOLD, 1972a, table 2.

_Cytheridea? rohri_ (Bold), BOLD, 1976, p. 31.

**Distribution:** Talparo Formation, Trinidad; Siquire and Guiria formations, Venezuela.

**Remarks:** The record of this species from the Gransaul member of the Springvale Formation (Bold, 1963, table 5) is a drafting error, it should have been reported as _Cytheridea mediatena_ Bold (1963, p. 376, pl. 2, figs. 3a-d; pl. 11, fig. 3).

**Diagnosis:** A species of _Cytheridea_? with smooth to weakly pitted surface, very shallow submedian sulcus, flattened marginal area in anterior end, obliquely truncate posterior end, and projecting posterior cardinal angle in the left valve.

**Description:** _FEMALE:_ Left valve in side view elongate subrectangular, highest in the middle third of the carapace. Anterior margin evenly rounded, laterally flattened to a carina; dorsal margin convex, flattened in the middle third where it is parallel to the slightly sinuate ventral margin; posterior margin obliquely rounded, more narrowly rounded below the middle, upper portion obliquely truncate. In the right valve the dorsal margin more strongly convex, posterior end obliquely truncate and narrowly rounded ventrally. Dorsal view with strongly compressed anterior margin, width about equal in anterior and posterior portions with a shallow-compressed area in between. Surface smooth to weakly punctate.

_MALE:_ More elongate and lower; posterior end more obliquely truncate, narrowly rounded ventrally. Marginal area narrow, radial pore canals numerous, evenly spaced, about 30 in anterior end, short, mostly straight, a few bifurcating. Line of concrescence and inner margin coinciding throughout. Hinge in the left valve with a very elongate anterior socket, about 0.20 mm long and crenulate, anteromedian element a very short tooth, posteromedian element a long (0.25 mm) shallow, crenulate groove, posterior socket short. Muscle scars forming a vertical row of four, located in the submedian sulcus and two small frontal scars, situated close together. Mandibular fulcrum point between frontal scars and first and second adductor scars; two small, mandibular muscle-scar located vertically below the frontals.

**Dimensions:** _Tuy Formation:_ Female left valve: L 0.68 mm, H 0.36 mm; right valve: L 0.64 mm.

**Figures**

1-2. _Limnocythere_ sp. 1, HVH 10787, loc. CB 77-868, Siquire Formation. 75 X. 1, Left valve view; 2, dorsal view.

3-4. _Limnocythere_ sp. 2, HVH 10789, loc. CB 77-902, Siquire Formation. 3, Left valve view. 100 X; 4, dorsal view. 75 X.

5-6. _Limnocythere_ sp. 3, HVH 10750, loc. CB 77-885, Siquire Formation. 85 X. 5, Left valve view; 6, dorsal view.

7-8. _Limnocythere_ sp. 4, HVH 10752, loc. VB-1, Tuy Formation. 95 X. 7, Left valve view; 8, dorsal view.

9-10. _Cytheridella boldi_ Purper, HVH 10754, loc. CB-77-898, Siquire Formation. 50 X. 9, Right valve view, female; 10, dorsal view, female.

11-13. _Callistocythere? macsotayi_ n. sp., Unit J, Guiria Formation. 11, HVH 10772, right valve view, female, holotype. 75 X; 12, left valve view, female, HVH 10773. 75 X; 13, HVH 10774, right valve view, male. 100 X.

**PLATE 2**
mm. H 0.34 mm; Male left valve: L 0.77 mm, H 0.38 mm; large female left valve: L 0.72 mm, H 0.36 mm.

Guiria Formation: Female left valve: L 0.67 mm, H 0.36 mm, right valve: L 0.67 mm, H 0.35 mm; Male carapace: L 0.76 mm, H 0.37 mm, W 0.24 mm; left valve: L 0.76 mm, H 0.37 mm.

Name: In honor of Dr. Ivone Purper, Instituto de Geociencias, Universidade Federal do Rio Grande do Sul, BRASIL.

Holotype: HVH no. 10755: right valve, female.

Paratypes: Male and female left and right valves: HVH nos. 10756-10760.

Type locality: VB-1 (Coll. P. J. Bermúdez), roadcut between Charallava and Santa Teresa, Estado Miranda, Venezuela (Bermúdez, 1966, p. 344).

Stratigraphic horizon: Tuy Formation.

Distribution: Upper part of Siqueire Formation, Tuy Basin, upper part of Guiria Formation (Unit E).

Remarks: Cytheridea? purperae differs in some respects from typical Cytheridea and can only be assigned questionably to this genus. It probably does not belong to the "Cytheridea" group that developed in northern Venezuela and Trinidad from a stock of questionable Hemicyprideiidae? species (e.g., Hemicyprideiidae? cagigalen sis). (See Bold, 1976, p. 31 for discussion.)

Cytheridea pebasae Purper (1979, p. 228, pl. 2, figs. 11-25) is similar in size and in side view outline, but more rectangular in dorsal view and has a more distinctly pitted surface and a dentate anterior end. Sheppard and Bate (1980) combined this species with Cytheridea graciosa Purper and Cytheridea longispina Purper under the name Cyprideis purperi purperi (1980, p. 99, pl. 7, figs. 1-13). Ivone Purper compared some of my specimens with her Brasilian material and concluded that although similar the two species are not identical (letter 16 March, 1979).

Family LIMOCYTHERIDEAE Klie, 1938
Genus LIMOCYTHERE Brady, 1868

In the Sta. Lucia-Ocumare del Tuy basin four species of Limocythere occur. Originally it was thought that two of the species might be molts of the other two, but all four show distinct sexual dimorphism. These species are not named because I do not have exact localities and the interior could not be studied.

LIMOCYTHERE sp. 1
Plate 2, figs. 1-2

Description: Carapace subrectangular in side view, dorsal and ventral margin roughly parallel. Anterior margin evenly rounded, posterior margin bluntly angled in the middle, obliquely truncate above and below. Lower part of posterior margin extending below the ventral margin with a small notch just in front of the posteroventral angulation. Ventral surface concave. Surface finely reticulate. Subcentrally a deep median sulcus separating an anterocentral and a posterodorsal swelling. A posteroventral swelling with a broad knob, separated from the posterodorsal swelling by a shallow depression. From the middle of the subcentral sulcus a shallower sulcus extends upward and forward, enclosing a small knob, separated from the inconspicuous eye-node by a shallow depression. Dorsal view irregular in outline with compressed anterior end, greatest width at the node of the posteroventral swelling at about 1/3 of the length from the posterior extremity. Interior not studied. Male much more elongate, highest in

Figures
1-7. Cytheridea rohri (Bold). 1, HVH 10761, right valve view, female, loc. CB 77-885, Siqueire Formation. 50 X; 2, HVH 10762, right valve view, female, loc. CB 77-898, Siqueire Formation. 50 X; 3, HVH 10763, dorsal view, female loc. CB 77-885, Siqueire Formation. 50 X; 4, HVH 10764, right valve view, male, loc. CB 77-885, Siqueire Formation. 50 X; 5, HVH 10765, dorsal view, male, loc. CB 77-885, Siqueire Formation. 50 X; 6, HVH 10766, right valve, male, Unit J, Guiria Formation. 50X; 7, HVH 10767, left valve, male, Unit J, Guiria Formation. 60 X.
8-11. Xestoleberis bermudezi n. sp., Unit J, Guiria Formation. 110 X. 8, HVH 10776, holotype, right valve view, female; 9, HVH 10777, dorsal view, female; 10, HVH 10778, right valve view, male; 11, HVH 10779, dorsal view, male.
12-15. Perissocytherea cytherellaformis Forester, Unit J, Guiria Formation. 12, HVH 10769, right valve view, female 80 X; 13, HVH 10769, left valve view, male. 85 X; 14, HVH 10769, dorsal view, female. 80 X; 15, HVH 10769, dorsal view, male. 85 X.

PLATE 3
the posterior fourth with anteriorly converging dorsal and ventral margins.

**Dimensions:** Female: L 0.61 mm, H 0.33 mm, W 0.28 mm; Male: L 0.73 mm, H 0.36 mm, W 0.27 mm.

**Distribution:** Basal Sigure Formation.

**LIMNOCYthere sp. 2**
Plate 2, figs. 3-4

**Description:** Very similar in side view to *Limnocythere* sp. 1, but much smaller; posterior and more regularly rounded. Node on ventral swelling the most conspicuous tubercle at 0.36 of the length from the posterior extremity; greatest width in this position. Almost vertically above it a dorsal node; both very prominent in dorsal view. This species is believed to be a descendant of *Limnocythere* sp. 1.

**Dimensions:** Female: L 0.43 mm, H 0.23 mm, W 0.26 mm; Male: L 0.46 mm, H 0.23 mm, W 0.20 mm.

**Distribution:** Upper Sigure Formation.

**LIMNOCYthere sp. 3**
Plate 2, figs. 5-6

**Description:** Carapace in side view subrectangular. Anterior margin almost regularly rounded, dorsal margin straight, ventral margin strongly concave, posterior margin rounded in the middle, gently convex above and below. A vertical subcentral sulcus containing the adductor scars; a shallow depression at the place of attachment of the frontal muscles. Central part of the carapace swollen, the ventral termination of the swelling converging posteriorly towards the dorsal margin and ending abruptly at about 1/3 of the length from the posterior extremity in front of a depressed area. Behind this the carapace exhibits a posteroventral swelling connected to a posterodorsal swelling. Only one carapace with very weak reticulation, others smooth. Dorsal view narrow, spindle-shaped, ends compressed, especially the anterior. Greatest width at the posterior end of the ventral swelling at 1/3 of the length from the posterior; in the male the greatest width at about 1/4. Males longer and having the greatest height in the posterior fourth of the carapace. Dorsal and ventral margin converging anteriorly.

**Dimensions:** Female: L 0.59 mm, H 0.28 mm, W 0.22 mm; Male: L 0.63 mm, H 0.27 mm, W 0.20 mm.

**Distribution:** Lower Sigure Formation.

**Remarks:** Similar in general appearance to *L. sappaensis* Staplin (1963, p. 1197, pl. 160, figs. 4-6) from the Pleistocene of South Dakota, Nebraska, Iowa, and Kansas but that species is more clearly reticulate and lacks the posteroventral swelling.

**LIMNOCYthere sp. 4**
Plate 2, figs. 7-8

**Description:** Very similar to sp. 3, but much smaller. In the female the posterior end of the ventral swelling projects laterally as a tubercle.

**Dimensions:** Female: L 0.44 mm, H 0.23 mm, W 0.20 mm; Male: L 0.51 mm, H 0.25 mm.

**Distribution:** Tuy Formation.

**LIMNOCYthere STAPLINI Gutentag and Benson**

**Limnocythere staplini** GUTENTAG and BENSON, 1962, p. 51, figs. 1-3, text-fig. 15; BOLD, 1975a, p. 612, pl. 59, fig. 8a, b.

**Limnocythere sp.** BOLD, 1972a, p. 1012.

**Dimensions:** L 0.57 mm, H 0.30 mm (HVH 10753).

**Distribution:** Pleistocene, Kansas; Las Salinas and Jimani Formations (Late Pliocene to Pleistocene?) Hispaniola; Cumaca Formation, Venezuela; Recent, Bahamas, North America.

**Genus CYTHERIDELLA Daday, 1905**

**Cytheridella boloti** Purper.
Plate 2, figs. 9-10

Cytheridella bolodi PURPER, 1974, p. 654, pl. 10, figs. 1-4.

Cytheridella ilosvayi Daday, BOLD, 1975a, p. 613, pl. 58, fig. 1 a-g; pl. 6, fig. 3a, b (not DADAY, 1905).

**Dimensions:** Female: L 0.87 mm, H 0.49 mm, W 0.49 mm; Male: L 0.86 mm, H 0.47 mm, W 0.48 mm.

**Distribution:** Sigure Formation, Recent, Lago de Valencia, Venezuela; upper Talparo Formation, Trinidad; Jimani Formation, Hispaniola.

**Remarks:** The specimens from the Sigure Formation and from cuttings of a well (material from M. Dempsey) in the Talparo Formation (northern basin, Trinidad) are all slightly distorted, but show the typical “square” posterior portion of the female, different from *C. ilosvayi* and *C. danielopoli* Purper (1979, p. 243, pl. 7, figs. 21-27). I am not certain if the distinct pattern of pitting in *C. postornata* Sheppard and Bate (1980, p. 108, pl. 10, figs. 1-7) is sufficient to separate this species from *C. danielopoli*. Typical (but again distorted) specimens of *C. postornata* have been found in the “Chara zone” of Huila (Colombia), where they occur together with specimens of *Darwinula fragilis* Purper, *Cypria aequalica* Sheppard and Bate, *Pelocypris zilchi* Triebel.
Proparacytheridea acuminata Purper, Perissocytheridea n. sp., and Pacamboctheria campana (Sheppard and Bate) (= Ambocytheria? campana Sheppard and Bate, 1980, p. 110, pl. 11, figs. 1-9), which is the most common ostracode there (Pl. 1, fig. 12). This suggests a possible correlation of the "Chara zone" with the Pebas Formation and its southeastern Colombian equivalents.

Family CYTHERIDAE Baird, 1850
Subfamily PERISSOCYTHERIDEINAE Bold, 1963
Genus PERISSOCYTHERIDEA
Stephenson, 1938
Perissocytheridea subrugosa (Brady)
Plate 1, figs. 13-14
Cythere subrugosa BRADY, 1870, p. 238, pl. 30, figs. 18, 19.

Perissocytheridea subrugosa (Brady), BOLD, 1958a, p. 71, tables 1, 3; 1963, p. 380, pl. 4, fig. 2 a-d; 1966, pl. 1, fig. 7 a, b; TEETER, 1975, p. 432, figs. 6 j, 7 f, g; BOLD, 1978 b, table 9.

Distribution: Pliocene to Recent: Greater Antilles, Northern South America, Costa Rica; Lower Guiria Formation, Venezuela.

Perissocytheridea cytheridellaformis Forester Plate 3, figs. 12-15
Perissocytheridea n. sp. BOLD in MACSOTAY 1968, p. 64.

Perissocytheridea cytheridellaformis FORESTER in BOLD, 1975a, pp. 610, 618, pl. 60, fig. 8 a-e; pl. 61, fig. 1 a, b; pl 62, fig. 1 a, b, tables 3, 6, 7.

Distribution: Upper Las Salinas Formation, Hispaniola; lower Guiria Formation, Venezuela.

Family LEPTOCYTHERIDA Haai, 1957
Genus CALLISTOCYTHE Ruggieri, 1953
Callistocythere? macsotayi n. sp.
Plate 2, figs. 11-13
Diagnosis: A species of Callistocythere? with a prominent, vertical, posterior ridge.

Description: Carapace in side view trapezoid to subrectangular, highest at 2/5 of the length from the anterior extremity, Anterior margin obliquely rounded, dorsal margin gently convex, ventral margin sinuate, converging posteriorly; posterior margin steeply truncate above, narrowly rounded ventrally. Ventral and dorsal surface flattened, but only barely delineated by longitudinal ridges. Surface irregularly reticulate. A pronounced anterior rim paralleling the anterior margin with 5-8 radial ridges projecting forward toward the margin. At 1/7 of the length from the posterior extremity a vertical ridge, the carapace strongly compressed behind. Weak ventral, dorsal and subdorsal ridges extend forward from the posterior ridge, becoming obscure in the middle of the valve. Dorsal view wedge-shaped, widest just in front of the posterior ridge.

Sexual dimorphism present. Male elongate-trapezoid in side view, lower and narrower than the female, with dorsal and ventral margin more nearly parallel in the posterior half. Greatest width at the posterior ridge. Interior not observed. Only closed carapaces were found.

Dimensions: Female: L 0.46 mm, H 0.26 mm, W 0.18 mm; Male: L 0.43 mm, H 0.21 mm, W 0.26 mm.

Name: After Oliver Macsotay, Oceanographic Institute, University of Oriente, Venezuela, in honor of his work on the Guiria, Siquirre and Tuy formations.

Holotype: HVH no. 10772, female carapace.
Paratypes: HVH no. 10773-10775, male and female carapaces.

Type locality: Sample 496a (Macsotay, 1968, p. 55), in small ravine 500 m NE of the stone pier at Guiria.

Distribution: Only in Unit J of the Guiria Formation.

Remarks: This species differs from other species of Callistocythere described from the Atlantic and Pacific coast of America by having a vertical posterior ridge instead of the general gradual curvature of ridges in the posterior end.

Family TRACHYLEBERIDIDAE
Sylvester-Bradley, 1948
Subfamily TRACHYLEBERIDINAE
Sylvester-Bradley, 1948
Genus CATIVELLA Joryell and Fields, 1938
Cativella pulleyi Teeter Cativella aff. semitranslucens (Crouch), BOLD, 1956b, p. 404, pl. 3, fig. 3; 1963, p. 389, pl. 11, fig. 6; 1978b, table 9.

Cativella pulleyi TEETER, 1975, p. 451, figs. 12, 12 c-e; BREMAN, 1982, pl. 4, fig. h.

Distribution: Middle Miocene to Recent: Caribbean; Unit J of the Guiria Formation, Venezuela.

Subfamily CAMPYLOCYTHERINAE
Puri, 1960
Genus BASSLERITES Howe, 1937
Basslerites minutus Bold Basslerites minutus BOLD, 1956, p. 405, pl. 3, fig. 8; pl. 5, fig. 5 a-c; MORALES, 1966, p. 62, pl. 5, fig. 3 a, b; BREMAN, 1982, p. 237.
Distribution: Lower Miocene to Recent, Caribbean; Unit J of the Guiria Formation, Venezuela.

Family LOXOCONCHIDAE Sars, 1925
Genus LOXOCONCHA Sars, 1965

Loxoconcha levis Brady

Loxoconcha levis Brady, 1870, pp. 238, 242, pl. 32, figs. 7, 8; BOLD, 1963, p. 393, pl. 9, fig. 10 a, b; TEETER, 1975, p. 473, fig. 18g, 19 a, b; BOLD, 1968, pp. 22, 25, 30; 1975a, pp. 577, 578, 583, 585, 590, 604; 1975b, pp. 122, 127; 1978, table 9; 1981, p. 81, pl. 5, fig. 11 a, b.

Distribution: Pliocene to Recent, Caribbean; Unit J of the Guiria Formation, Venezuela.

Family XESTOLEBERIDIDAE Sars, 1928
Genus XESTOLEBERIS Sars, 1866

Xestoleberis Bermudezi n. sp.

Plate 3, figs. 8-11

Description: FEMALE: In side view almost forming a 120 degree circle-sector, elongate, highest at 3/5 of the length from the anterior extremity. Anterior margin with dorsal slope from the greatest height, narrowly rounded ventrally; dorsal margin short, gently convex, converging to ventral posteriorly; posterior margin rounded subventrally, dorsal slope steep and slightly convex. Ventral surface strongly flattened, somewhat concave. Dorsal view bullet-shaped, widest at 1/3 of the length from the posterior end, acuminate anteriorly, broadly rounded posteriorly.

MALE: Similar in shape but lower in side view, greatest height just behind the middle, slope of the dorsal part of posterior margin less steep than in female, more narrowly rounded ventrally. Dorsal view widest in the middle, posterior end less broadly rounded than in female.

Dimensions: Female: L 0.38 mm, H 0.19 mm, W 0.23 mm; Male: L 0.35 mm, H 0.16 mm, W 0.19 mm.

Name: After the late Dr. P. J. Bermudez.

Holotype: HVH No. 10776, female carapace.

Paratypes: HVH No. 10777 (female carapace), 10778, 10779 (male carapaces).

Type locality: 496a of Macostay, 1968, p. 55, in small ravine, 500m NE of the stone pier at Guiria.

Stratigraphic horizon: Base of Unit J of Macostay, Guiria Formation.

Distribution: Only in Unit J of the Guiria Formation.

Remarks: The species is similar in side view to X. chilensis Hartmann (1962, p. 219, figs. 118-130), but has the greatest height more posteriorly. In dorsal view, the greatest width is also more posteriorly. In side-view it is almost a duplicate of X. tomkilenyi Bate et al., 1982 (p. 68, pl. 68, figs. 42 K-S, 43 A-Q, 44F) from the Galapagos islands, except for the lack of posteroventral nodes. The male, however, is more tapering posteriorly in side-view.

VII. LITERATURE CITED


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