The Jackson Eocene Ostracoda of Mississippi

WILLIAM J. HUFF

BULLETIN 114

MISSISSIPPI GEOLOGICAL, ECONOMIC AND TOPOGRAPHICAL SURVEY

WILLIAM HALSELL MOORE
Director and State Geologist

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LETTER OF TRANSMITTAL

Office of the Mississippi Geological, Economic and

Topographical Survey

Jackson, Mississippi

October 1. 1970

Mr. S. F. Thigpen, Jr., Chairman and

Members of the Board

Mississippi Geological Economic and Topographical Survey

Gentlemen:

I am pleased to transmit to you Mississippi Geological Survey Bulletin 114, "Jackson Eocene Ostracoda of Mississippi," by William J. Huff.

This bulletin is the result of years of study on this important fossil group. New species are named and important data on frequency and distribution of Ostracoda is presented. Bulletin 114 will be a welcome addition to the paleontology of our State.

Respectfully submitted,

William H. Moore

Director and State Geologist

THE JACKSON EOCENE OSTRACODA OF MISSISSIPPI

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THE JACKSON EOCENE OSTRACODA OF MISSISSIPPI

William J. Huff[1]

ABSTRACT

The Jackson group in Mississippi is divided into two formations, the Moodys Branch formation and the Yazoo formation. The Moodys Branch is further subdivided into two members, a greensand member and an upper marl member. The Yazoo formation is not formally differentiated in Yazoo, Madison, Hinds, Rankin and Scott counties, but it is divided into four member units in Jasper, Clarke and Wayne counties. These are the North Twistwood Creek clay, the Cocoa sand, the Pachuta marl and the Shubuta clay members. The undifferentialted Yazoo formation may be described, in general, as grayish-green, blocky, calcareous and fossiliferous clay. The North Twistwood Creek clay may be generally described as green or gray, slightly glauconitic, micaceous, fossiliferous clay. The Cocoa sand is blue-green or gray-green, fine-grained, massive, glauconitic, micaceous, fossiliferous sand. The Pachuta marl is gray to white, generally glauconitic, partially indurated, sandy marl. The Shubuta clay is light grayish-green, calcareous to non-calcareous, blocky, fossiliferous clay.

One hundred seven species of ostracods were were found in one hundred forty samples along the strike of the outcrop of the Jackson group in Mississippi. Twenty one species and one genus are described as new. Many of the species previously assigned to such genera as *Brachycythere*, *Cytherereis*, *Cytheridea*, *Cytherideis* and *Haplocytheridea* of the older literature on Eocene otracods are illustrated under more recent classifications to such genera as *Actinocythereis*, *Acanthocythereis*, *Clithrocytheridea*, *Cushmanidea*, *Cyamocytheridea*, *Digmocythere*, *Henryhowella*, *Hermanites*, *Occultocythereis*, *Opimocythere*, *Phractocytheridea*, *Trachyleberis* and others.

The most diversified ostracod faunas occur in the Moodys Branch greensand and the Pachuta marl. Each formation and member unit can be distinguished by a characteristic ostracod fauna but only a few species are generally found to be exclusive to a particular unit.

The ostracod and foraminiferal genera suggest that the Moodys Branch formation greensand was deposited well within the inner sublittoral zone of a transgressing sea. The upper marl member was deposited at greater depth but probably not exceeding the midsublittoral zone. The Yazoo formation clays of the west-central and central part of the state represent deposition at depths ranging from the midsublittoral to the outer sublittoral zone. The North Twistwood Creek clay was deposited in a depth range from the inner to the midsublittoral zone. The Cocoa sand was deposited at depths approximating the outer part of the inner sublittoral zone. The depth of deposition of the Pachuta marl is placed approximately in the range from the midsublittoral to the inner part of the outer sublittoral zone. The Shubuta clay was deposited well within the outer sublittoral zone.

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The Moodys Branch is easily traceable throughout the state both lithologically and faunally. The lower Yazoo formation of the west-central and central counties is correlative, in general, to the North Twistwood Creek clay through the Pachuta marl of the eastern counties. Age equivalence of the Shubuta clay to the upper Yazoo formation of the central area can be established by ostracods. In general, the Jackson group in Mississippi may be correlated to age equivalent strata in adjacent Gulf Coast states by the ostracod fauna.

INTRODUCTION

The Jackson group is one of the most intensively studied sections in the Mississippi Embayment. The volume of significant work resulting from this interest was pointed up long ago by Howe (1947b) when he discussed the status of micropaleontology in the eastern Gulf region. Even then he accounted for forty seven papers on Foraminifera and eight papers on Ostracoda. Many more have been added in the last score of years. Numerous species of other microfaunal groups, such as comatulids, bryozoans, otoliths and others, have also been added.

The works on Jackson Eocene stratigraphy are also relatively voluminous. This emphasis is readily understood when one considers that these richly fossiliferous strata often comprise key beds for subsurface correlation in oil wells in many parts of the Gulf Coast region. In spite of this extensive micropaleontological literature, however, there has been little or no systematic study of one of the most stratigraphically useful microfaunal groups, the Ostracoda, from the type areas of the Jackson group. It is the essential purpose of this study to fill this need and thus to provide another link in the chain of studies of important microfaunal groups of the Mississippi Embayment.

Within the last two decades many papers have appeared in diverse journals which have reassigned to new genera many of the Tertiary ostracod species previously described in the older literature of the thirties and forties. The rich ostracod fauna of the Jackson group in Mississippi has made it possible to illustrate a large number of these taxonomic revisions in one paper thus bringing into focus a large segment of the work on the Gulf Coast Tertiary ostracods of the last twenty years.

The ostracod fauna combined with the highly abundant foraminiferal fauna of these sediments also provided an opportunity for a brief study of the approximate depths of deposition of the various Jackson units. A cursory survey of the most abundant common foraminiferal genera was made from a few carefully selected samples. The Moodys Branch formation was sampled at the alternate type locality in Jackson, Mississippi. In all other units, especially the clay members of the Yazoo for-

mation, the samples were collected vertically in the section as they were selected areally from different localities along the strike. The samples were prepared for examination by a technique modified from the Shepard and Moore (1954) "coarse fraction analysis". The common foraminiferal genera in each sample were identified and relative percentages calculated. The percentages of genera for all the samples of a member unit were then combined into one composite sample representing that particular stratigraphic unit. (See Table 1.)

All of the Jackson group formations and member units in Mississippi are marine. All of the ostracod fauna and most of the Foraminifera used in this study are benthonic. Thus the marine environmental zones used in this report are the sublittoral (0-600 feet), inner sublittoral (0-300 feet), outer sublittoral (300-600 feet) and upper bathyal (600-1500 feet). In making comparisons of the Jackson ostracods with Recent forms the papers most useful were those of H. S. Puri and N. C. Hulings (1957), R. H. Benson (1959), D. M. Curtis (1960), R. H. Benson and G. L. Coleman (1963), N. C. Hulings (1967), and P. L. Engel and F. M. Swain (1967). The principal sources of information on ecology of Recent Foraminifera came from the classic work of S. W. Lowman (1949), Fred B. Phleger (1951) (1954) (1955), Parker, Phleger and Pierson (1953), O. L. Bandy (1954) (1956), F. D. Smith (1955), Robert R. Lankford (1959) (1966), K. J. Loep (1965) and the report by the New Orleans Paleoecologic Committee, Gulf Coast Section, SEPM (1966).

This report is one part of a thesis submitted to the Rice University more than ten years ago as fulfillment of part of the requirements for the doctor of philosophy degree. There has been considerable revision, however, because of more recent taxonomic literature. Also, several more core samples and cuttings of Jackson group sediments have been incorporated into this study as a result of the type section sampling program completed by the Mississippi Geological Economic and Topographical Survey in 1964. (See MGETS Bull. 104.)

PHYSIOGRAPHY AND SURFACE STRUCTURE

The Jackson group in Mississippi crops out in a wedge-shaped northwest-southeast band that trends essentially across

the central part of the state. It varies irregularly in width from approximately thirty-one miles along the Yazoo River in west-central Mississippi to approximately four miles in width in Wayne County near the Alabama line. The eastern boundary of the argillaceous Jackson is placed approximately at the Tombigbee River in Alabama where limes of the Ocala group begin.

Only brief mention of some of the more important structures and physiographic features will be made since previous publications have covered this subject thoroughly. See Hilgard (1860), Hopkins (1916), Monroe (1931), Morse (1935), Mellen (1940), Tourtelot (1944), Monroe (1954), Priddy (1960), Moore (1965) and Bicker (1965).

The physiography of the outcrop band of Jackson sediments is essentially that of its thicker formation, the Yazoo clay. This formation forms the Jackson Prairie which lies between the North Central and the Southern Pine Hills provinces. It is generally an area of slightly rolling and low relief with grass as the predominant vegetation. Priddy (1960), however, described a large cuesta several hundred feet in breadth formed in the Moodys Branch formation in the hills overlooking Pearl River and in the valley of the Big Black River in Madison County.

The Yazoo clay is very amenable to slippage and often swells. This characteristic sometimes adds unusual minor features to the Yazoo Prairie landscape. Monroe (1932) reported cracks en echelon on the south side of Mars Hill in Rankin County and Morse (1935) reported landslides in the Yazoo formation affecting railroads, highways and the city reservoir in Yazoo City, Mississippi. Moore (1965) discussed the difficulties encountered in building houses and streets on the Yazoo formation in Jackson, Mississippi.

The most noteworthy structural feature affecting Jackson group surface exposures is the Jackson Dome which is located in the northeastern part of Hinds County with the city of Jackson over its apex. An excellent description of this structure has been given by Moore (1965) and Bicker (1965). Bicker (1965) described it as a broad structural uplift twenty-five miles wide and slightly elongate in the northwest and the southeast directions. The dips vary with depth and direction with the greatest dips at four hundred feet per mile to the southwest in the Midway shale. Moore (1965, plate 2) showed that the Moodys

Branch dips toward the southwest and west at approximately one hundred feet per mile in the western part of Townships 5 and 6 North, Range 1 West, in Hinds County. Monroe (1954) mapped several synclines in the Jackson area. The most prominent of these is the Brandon Syncline which is a structural trough southeast of Jackson with a northeast-southwest axis that extends through Brandon, Mississippi.

Another prominent structure affecting Jackson sediments is the Tinsley Dome in Yazoo County mapped by Mellen in 1939. This Dome determined the location of the first oil field in Mississippi. It is located approximately six miles south of Yazoo City and has a surface closure of one hundred thirty-five feet. Other structures in the area described by Mellen (1940) include a fault near Satartia, Mississippi, and several small faults in the northeastern section of the county.

On the eastern side of the state, in Clarke and Wayne counties, Tourtelot (1944) mapped a zone of faults called the Quitman Fault Zone. The largest of these, the Quitman Fault, has an east-west trend approximately across the center of Clarke County through Quitman, Mississippi. It is eleven miles long with the downthrown side to the north and a maximum displacement of one hundred feet at Quitman. Another fault, between Barnett and Pachuta, Mississippi, called the Pachuta Fault, is approximately four miles in length and extends westward a short distance into Jasper County. The downthrown side is to the north with about fifty feet of displacement. This fault brings the lower part of the Yazoo clay into contact with the Cockfield formation. The lower Yazoo is forty feet higher at Barnett, Mississippi, than it is on the south side of Pachuta Creek one half mile to the north.

Another fault, called the Gilbertown Fault, extends westward into Wayne County, Mississippi, from near Gilbertown, Alabama. This fault has a large displacement near Gilbertown but it generally dies out just within Wayne County. Other small faults also have been mapped in the general area.

STRATIGRAPHY

HISTORICAL REVIEW OF THE NOMENCLATURE

Eocene age sediments were first recognized in North America by T. A. Conrad (in Harris, 1894) who referred beds at Ft.

Washington, Maryland, to the London clay formation. Conrad substituted the terms Upper, Middle, and Lower Tertiary for the nomenclature used by European geologists; and Morton (1833) extended the usage of Conrad's terms to the southeast. Rogers and Rogers (1839) later applied the name "Eocene" to the beds described by Conrad at Ft. Washington.

In 1846 Conrad published faunal lists from the limes of Claiborne, Alabama, strata at Vicksburg, Mississippi, and the beds on the Ouachita River in Louisiana and referred all of these beds to the Eocene Series. In 1848 he noted that one hundred three of these species from the Vicksburg beds were distinguishable from those of the previously mentioned localities. He then subdivided the Eocene into a *Newer Eocene* comprised of the deposits at Vicksburg, Mississippi, and St. Stephens, Alabama, and an *Older Eocene* represented by the beds at Claiborne, Alabama.

Sir Charles Lyell (1847) noted that fossils from beds at Jackson, Mississippi, were more nearly correlative with those from Claiborne, Alabama, than with the fossils at Vicksburg, Mississippi. He also pointed out that the "Nummulitic" limes of Alabama were younger than those containing Zeuglodon (now *Basilosaurus cetoides* (Owen) of the Pachuta marl member of the Yazoo formation).

In 1854 Wailes published color plates of forty species of testacea which were described by Conrad in 1855. Conrad then further subdivided the Eocene of the southeast into three groups: Older Eocene, *Claiborne;* Older Eocene, *Jackson;* and Newer Eocene, *Vicksburg.* Hilgard (1860), however, noted that strata exposed at Red Bluff station in Wayne County, Mississippi, separated the Jackson from the overlying Vicksburg beds. Finally, in 1866, Conrad referred the Vicksburg deposits to the Oligocene.

Meyer (1885) after much criticism of previous Tertiary stratigraphy reversed the order of Conrad's groups and designated the Claiborne as youngest and the Vicksburg as oldest. Langdon (1886) considered the Jackson Zeuglodon bearing beds as older than the Vicksburg orbitoidal limes of Mississippi and Alabama; but Smith and Johnson (1887) considered the entire white limestone sequence of Alabama, including both Zeuglodon

and orbitoidal beds, as a single unit equivalent in age to the Jackson and Vicksburg groups of Mississippi and referred to them as Upper Eocene. Clark (1891) also referred to the Jackson and Vicksburg as stages of the *Eocene,* as did Harris (1894) who also denoted the "Moodys Branch Beds" as a substage of the Jackson. Dall (1897) correlated the Tertiary of America with that of Europe and distinguished the Jackson as the youngest stage of the Eocene. The terms Marks Mills beds, Moodys Branch beds, and Zeuglodon beds were used by Dall (1897) as substages of the Jackson.

Lowe (1915) was the first geologist to specifically identify formations within the Jackson group. He recognized the Moodys Branch Green Marls, named for beds along a small tributary to the Pearl River at Jackson, Mississippi; the Yazoo Clay Marl, for clays on the Yazoo River bluffs near Yazoo City, Mississippi; and the Madison Sand, for the overlying beds which he described as deltaic sands and clays. Lowe questioned the Jackson age of the latter formation. Hopkins (1916) also questioned the Jackson age of the Madison Sand. Cooke (1918) referred the Madison Sand to the Oligocene and changed the name to Forest Hill Sand because the name Madison was preoccupied. Moore (1965) also placed the Forest Hill in the Oligocene. Cooke (1918), however, considered the Jackson a formation and believed that the Moodys Branch marl and the Yazoo clay marl were its members because they "intergrade so much that it seems advisable to consider them members of the same formation." He also considered the Jackson as an equivalent to the Ocala limes east of the Tombigbee River in Alabama.

In 1926 Cooke shortened the names of the Jackson members to Moodys marl member and Yazoo clay member. Lowe (1928), Grim (1928), Stephenson, Logan, and Waring (1928), and Monroe (1931) all used Cooke's nomenclature in describing the Jackson strata. In 1933 Cooke recognized another member of the Jackson, the Cocoa sand, in Choctaw County, Alabama. The recognition of this additional member was necessitated by the usage developed from a paper by Cushman (1925) that purported to describe Foraminifera from the *Cocoa Sand of Alabama.* Unfortunately, the Foraminifera had been collected from the clays well above the Cocoa sand as defined by Cooke. Grim (1936) considered the Jackson as a formation but included the

Forest Hill sand as a member because of its gradational nature with the underlying Yazoo clay. Cooke (1939) raised the Jackson to group status when he correlated the Moodys Branch *formation* with the Gosport sand of Alabama. Mellen (1940), however, continued to class the Jackson as a formation with the Forest Hill sand as a member. Bergquist (1942) included the latter as part of his Oligocene-Vicksburg series. In 1945 the United States Geological Survey adopted the names Moodys Branch formation and Yazoo Clay formation as subdivisions of the Jackson group (Monroe, 1954). Priddy (1960) used the Moodys Branch formation and the Yazoo formation. Moore (1965) pointed out that the Moodys Branch possesses the lithologic characteristics and extent of mappability as required to be defined as a formation by the Code of Stratigraphic Nomenclature of the American Commission on Stratigraphic Nomenclature.

Murray (1947) designated the North Creek clay, the Pachuta marl, and the Shubuta clay as members of the Yazoo formation. Subsequently Murray (in DeVries, 1963) redesignated the North Creek clay as the North Twistwood Creek clay in order to make the name of the type section conform to the correct name of the creek in the area. Murray and Wilbert (1950) have urged that the Jackson be referred to as a stage in the time-rock sense in order to free this heterogeneous body of sediments from the purely lithologic connotation involved in the group terminology.

In the present paper the Jackson is referred to as a group. This terminology is used because this study is made primarily to determine the similarities and differences of the ostracod fauna and the varying paleoecologic conditions among the different members as lithologic units.

THE JACKSON GROUP

INTRODUCTION

The Jackson group is comprised of two formations, a lower, Moodys Branch formation and an upper, Yazoo formation. In the west-central and central areas of the state (Yazoo, Madison, Hinds, Rankin and Scott counties) the Yazoo formation is undifferentiated, and in the eastern part of the state (Wayne,

Clarke and Jasper counties), it has been subdivided by Cooke (1933) and Murray (1947) (1963) into four members. Therefore, the discussion of the stratigraphy of the Yazoo formation will follow the geographic subdivisions aforementioned. Only a brief summary of the stratigraphy is made in this report and the reader is referred to reports of Mellen (1940), Bergquist (1942), Hendy (1948), Thomas (1948), Monsour (1948), Monroe (1954), Priddy (1960), DeVries (1963) and Moore (1965) for more detailed descriptions in the counties where the Jackson crops out.

THE MOODYS BRANCH FORMATION

GENERAL

The Moodys Branch is the basal unit of the Jackson group in Mississippi. It has a distinct fauna and lithology which make it one of the best mapping horizons in the Gulf Coast Tertiary.

Lowe (1915) named the Moodys Branch formation for exposures on Moodys Branch southeast of the junction of Poplar Boulevard and Hazel Street in Jackson, Mississippi. He did not subdivide it into smaller units but Garst, Monsour and Thomas (1948, in Guidebook, MGS, 6th Fld. Trip) described a greensand member, thirteen feet in thickness, and a marl member, four feet in thickness.

The Moodys Branch formation is essentially uniform lithologically throughout the state and, in general, it can be described as blue-green to gray-green, glauconitic, fossiliferous sands and marls weathering gray or reddish-brown or yellow in most places. Occasionally, it may contain indurated ledges of clayey limestone and in some places small lenses of black carbonaceous shale.

Mellen (1940) described the Moodys Branch formation in Yazoo County as a "glauconitic, argillaceous, fossiliferous sand marl" and reported thicknesses that ranged from thirty-one to forty-three feet. Priddy (1960) reported that most of the Moodys Branch outcrops in Madison County are so badly weathered that out of ninety-four exposures "only two can be recognized by their fossil content." He recognized "all but four on the basis of red ferruginous sandstone." Moore (1965) described the Moodys Branch outcrop in Hinds County as " a very limey, fossiliferous, clayey, glauconitic sand. It is green to gray-green in

fresh exposures and weathers to a yellowish color." He reported thicknesses of ten to fifteen feet in the outcrop area and a considerable range of thicknesses (six to thirty-five feet) around the Jackson Dome. In central Hinds County he reported the thickness to range from ten to twenty-five feet and developed to a maximum thickness of forty-five feet in the County. Monroe (1954) reported an average thickness of about twenty-five feet in the Jackson area. Bergquist (1942) described unweathered beds of Moodys Branch from drill holes in Scott County as "composed of medium-grained to fine-grained or silty, very glauconitic and somewhat pyritiferous gray and greenish-gray sand, the quartz grains being subangular and glassy." He also reported varying thicknesses of twelve to twenty feet. DeVries (1963) divided the Moodys Branch in Jasper County into upper and lower members and described the upper member as "greenish-gray, argillaceous, fossiliferous marls" and the lower member as "stratified, lignitic, argillaceous, interpolated silts and sands with thinner inner beds of fossiliferous, glauconitic, marly sands." Lowe (1915) described exposures of Moodys Branch of thirty-five feet thickness in the bluffs of Garland Creek in Clarke County. Subsequent work has shown that this figure is an erroneous estimate of the thickness of Moodys Branch beds along Garland Creek. Hendy (1948) summarized the stratigraphy of the Moodys Branch formation in northeastern Wayne County as consisting of an upper "10 to 15 feet of greenish, glauconitic, argillaceous, fossiliferous sand which in the upper few feet is calcareous and in places indurated to a thin, glauconitic, sandy lime. This fossiliferous zone rests on a transition zone averaging 10 feet in thickness."

The original type section is located in the city of Jackson just southeast of the corner of Poplar Boulevard and Peachtree Street. It was defined by Lowe (1915) and redescribed by Monroe (1954). It was described by Monroe as follows:

Transition zone with Yazoo clay.

Clay, light yellow to cream colored, calcareous with mollusk impressions, slightly glauconitic and plastic in upper part, and gradational with beds below ..... 18 feet

Moodys Branch formation

Yellow to gray, clayey, glauconitic, fossiliferous, sand, with calcareous nodules six feet above the base, and reworked clay pebbles in the basal foot ..... 13 feet

Unconformity ..... Alt. 276.5 feet

There is another excellent exposure called "fossil gulch" at the eastern edge of Riverside Park, near the Pearl River in the city of Jackson, which was designated by E. H. Rainwater (1957) as the alternative type section since the original type section is on private property and now inaccessible to the public. (See Fig. 1.) This section may be described as follows:

Description	Feet	Feet
Yazoo formation		6.0
Clay, grayish-green when fresh, light gray to buff on weathered surface, blocky, calcareous, slightly glauconitic	6.0	
Moodys Branch formation		17.0
Upper marl member		4.0
Sand and marl, slightly indurated, grayish-green fresh, weathers gray to buff, glauconitic, argillaceous, fossiliferous	4.0	

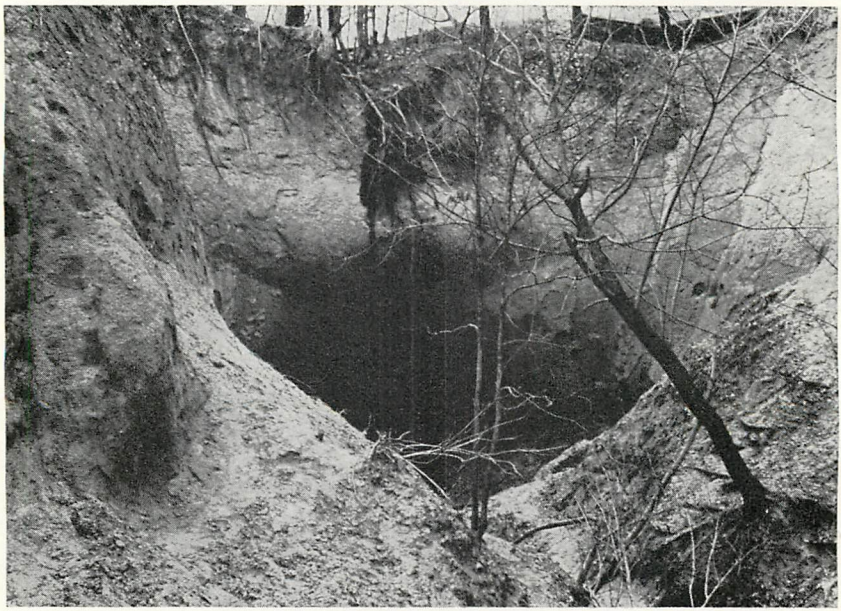


Figure 1.—Exposure of the Moodys Branch greensand, upper marl and lower Yazoo clay in the alternate type locality of the Moodys Branch in Riverside Park, Jackson, Mississippi, in NW¼, NW¼, Sec. 36, T6N, R1E. Photo by Perry Nations.

Greensand member		13.0
Sand, fine to medium grained, blue-green fresh, weathers gray, very glauconitic, very fossiliferous	13.0	
Transition zone of Cockfield and Moodys Branch formations		3.0
Sand, fine to medium-grained, intercalated with clays, dark gray-green, very glauconitic, lignitic, with reworked material from below	3.0	
Cockfield formation at bottom of gulch		Elev. (?)

The Mississippi Geological Economic and Topographical Survey drilled a stratigraphic test March 7, 1964, near the alternate type section and core samples were obtained from the Moodys Branch and Yazoo formations. (See Fig. 2.)

The best Moodys Branch section on the eastern side of the state is the classic Garland Creek section which is exposed on the south bluff of Garland Creek near Shubuta, Mississippi, in Clarke County. (See Figs. 3 and 4.) This section may be described as follows:

Description	Feet	Feet
Soil and vegetal cover (thickness variable)		5.0 to 10.0
North Twistwood Creek clay member (thickness variable along bluff)		5.0 (approx.)
Clay, grayish-green fresh, weathers gray to buff, blocky, calcareous, fossiliferous, some calcareous concretions	5.0 (approx.)	
Moodys Branch formation		8.0
Upper marl member		2.0
Sand, fine to medium-grained, dark blue-green fresh, weathers gray, glauconitic and very fossiliferous	2.0	
Greensand member		6.0
Sand, fine to medium-grained, dark blue-green fresh, weathers gray, glauconitic and very fossiliferous	6.0	

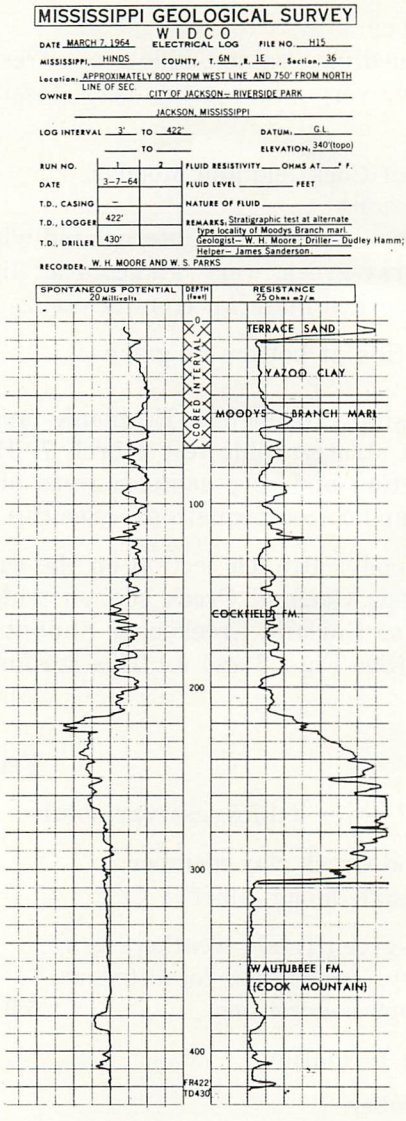


Figure 2.—Electrical log of hole drilled to sample the lower Yazoo formation and Moodys Branch formation in Riverside Park, Jackson, Mississippi.

Transition zone of Moodys Branch and Cockfield formations 14.5

Shale, dark gray fresh, weathers reddish brown, has small layers of marl interbedded 2.5

Sand, fine to medium-grained, dark green fresh, has 6" to 8" weathered surface reddish brown in color, flakes off in slabs, very argillaceous, silty, lignitic, slightly glauconitic	12.0	
Cockfield formation		7.0
Sand, fine to medium-grained, red, ferruginous, indurated, forms ledge	0.5	
Sand, fine to medium-grained, intercalated with shales, gray fresh, weathers red to chocolate color, lignitic, silty	6.5	
Edge of channel of Garland Creek		Elev. (?)

CONTACTS

COCKFIELD FORMATION—MOODYS BRANCH FORMATION

In general, the Moodys Branch formation overlies the Cockfield formation on a differentially eroded surface. The upper few feet of the Cockfield is commonly perforated by borings filled with glauconite, sand and shells from the Moodys Branch. Mellen (1940) reported that in many places in Yazoo County there are scattered fragments of worn lignitic wood in the base of the Moodys Branch. Priddy (1960) recognized four classes of Cockfield-Moodys Branch contacts in Madison County: (1) sharp contacts with Moodys Branch sand over a sandy clay zone of the Cockfield; (2) conformable contact with Moodys Branch sands over the sand and silt zone of the Cockfield; (3) sharp contact with Moodys Branch marls overlying the sandy clay zone of the Cockfield; (4) sharp contact with Moodys Branch marls overlying the sands and silts of the Cockfield. In Hinds County Moore (1965) simply reported the Moodys Branch-Cockfield contact as disconformable. Bergquist (1942) reported: "a small amount of lignitic material, reworked from the Yegua beds, is present in some places in the basal portion." DeVries (1963) in his Jasper County report stated: "the lower contact of the Moodys Branch is considered to fall at the base of the lower member." He interpreted the lower member as a "transitional facies from probable pro-deltaic deposition in the Upper Claiborne stage, to offshore, shallow marine deposition in the Lower Jacksonian."

In the Garland Creek section in Clarke County near Shubuta there is a large massive lignitic sand unit below the Moodys Branch called the "transition zone." Hendy (1948) suggested that this zone is contemporaneous with the Moodys Branch and the break between them should be considered a diastem. No ostracods were found in samples from this unit at Garland Creek and the lithology suggests that it is in part a shallow water lagoonal deposit inshore, and in part, continental involving the burial of much swamp-like vegetation. In this paper the lower Moodys Branch contact is placed at the top of the "transition zone."

Figure 3.—Partial exposure of Moodys Branch and Cockfield formations in the bluffs of Garland Creek near Shubuta, Mississippi, NW¼, NW¼, Sec. 28, T1N, R1E, Clarke County, Mississippi. The tablet and hammer are on the line of contact between the Moodys Branch above and the "transition zone" to the Cockfield formation below. The upper part of the Moodys Branch and the lower North Twistwood Creek clay member are obscured by slump and vegetal cover.

MOODYS BRANCH FORMATION—YAZOO FORMATION

The contact between the Moodys Branch and the Yazoo formations is everywhere gradational. At the type locality and other surface outcrops in Hinds County, Moore (1965) places the contact at a point where the sand and glauconite become negligible.

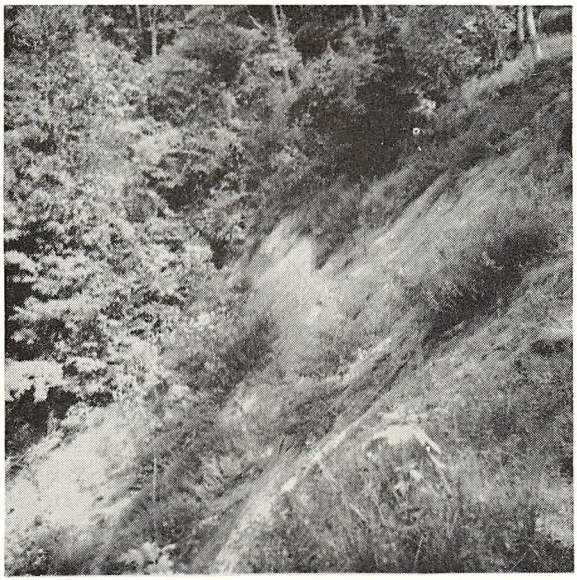


Figure 4.—The upper part of the Moodys Branch and the lower part of the North Twistwood Creek clay member exposed in a bluff in Garland Creek near Shubuta, Mississippi, in NW¼, NW¼, Sec. 28, T1N, R1E, Clarke County, Mississippi.

At the alternate type section in Jackson, Garst, Monsour and Thomas (1948) included the upper four feet of a slightly indurated, glauconitic marl as the upper part of the Moodys Branch formation giving it a total thickness of seventeen feet in that section. Even though this unit contains ostracod fauna which are characteristic of both the greensand below and the lower Yazoo clay above, it seems to have greater lithologic similarity to the greensand than to the overlying clays because there is still a considerable amount of glauconite and sand present. Also, there is a much greater degree of consolidation than that found in the overlying clays. For this reason the upper few feet of the sandy marl zone is designated as the *upper marl member* of the Moodys Branch formation in this paper.

Priddy (1960) recognized sixty Moodys Branch-Yazoo contacts in Madison County. Many were recognized as a result of the ferruginous sandstone of the upper Moodys Branch forming benches which hold up the sloping Yazoo clays; and others were recognized by color contrast between the buff-tan clays of the Yazoo and the red-brown clayey sands of the Moodys Branch.

DeVries (1963) reported the contact in Jasper County to be conformable and observed that the lower six or seven feet of the North Twistwood Creek clay contains "abundant glauconite."

In Clarke and Wayne counties the Moodys Branch-North Twistwood Creek contact has generally been placed at a limestone ledge in the upper part of the marl where developed.

The writer can also recognize by its ostracod fauna the upper marl unit in the upper two feet of the Moodys Branch in the Garland Creek section. This unit, however, is not readily distinguishable, lithologically, from the greensand member in this section.

THE OSTRACODA OF THE GREENSAND MEMBER

The Moodys Branch greensand member contains one of the richest and most diversified ostracod suites in the Jackson group. Sixty-four species were found in this member. The species found to be exclusive to the greensand in Mississippi are as follows:

Cushmanidea gosportensis (Blake)
Cytherura jacksoni n. sp.
Cytherura aff. C. ultra Blake
Eucythere undet. sp. C. (very rare)
Hemicythere bellula Howe
Hermanites moodysbranchensis n. sp.
Hirsutocythere hornotina Howe
Triginglymus longicostata (Blake)

In addition to those forms which are exclusive to the greensand member there are certain other species which are actually more characteristic and widespread in this member than they are in overlying strata. These include:

Absonocytheropteron carinata Puri
Actinocythereis nodosa n. sp.
Bairdoppilata sp. (Howe and Chambers)
Cushmanidea alta Blake
Cyamocytheridea hadleyi (Stephenson)
Cytherura moorei n. sp.
Hemicythere (?) *croneisi* n. sp.
Hermanites melleni n. sp.
Loxoconcha stavensis Blake
Monoceratina alexanderi Howe and Chambers

Opimocythere mississippiensis (Meyer)
Triginglymus hyperochus Blake
Tropidocythere carinata n. sp.

In general, such genera as *Absonocytheropteron, Clithrocytheridea, Cyamocytheridea, Cushmanidea, Cytherura, Hermanites, Hemicythere, Hirsutocythere, Opimocythere, Paracytheridea, Triginglymus* and *Tropidocythere* are more prevalent and widespread in the Lower Jackson (Moodys Branch through Cocoa sand) than in the overlying Pachuta marl and Shubuta clay or in the Yazoo formation upper and lower beds of the west central and central counties.

PALEOBATHYMETRY OF THE GREENSAND MEMBER

The genera *Brachycythere, Cytherura, Hemicythere* and *Paracytheridea* of the Moodys Branch greensand are some of the genera which are also found in Benson's (1959) Biofacies I of the Todos Santos Bay region, Baja California which he describes as a shallow shelf with coarse sands. Also, the genera *Bradleya* and *Quadracythere* of Benson's suite belong to the same family and have a similar morphology to some species of *Hermanites* in the Moodys Branch. Likewise, there are similarities of some of the Moodys Branch species to those found by D. M. Curtis (1960) to be diagnostic of the nearshore (inner neritic) subfacies of the East Mississippi Delta area of the Gulf of Mexico. She lists certain species belonging to the genera *Cushmanidea, Cytheretta, Cytherura* and *Loxoconcha,* among others, as diagnostic and, in her general assemblage for the inner neritic subfacies, she includes species of *Hermanites, Trachyleberis* and *Xestoleberis.* All of these species have close kindred with species of the same genera in the Moodys Branch.

The above conclusion is further corroborated by a study of the foraminiferal genera. (See Table 1.) It was found that the most abundant foraminiferal genera of the Moodys Branch greensand are members of the *Miliolidae* family such as the genera *Miliola, Massilina, Quinqueloculina, Articulina* and *Spiroloculina* which account for over 61% of the genera. (See Table 1.) This group suggests deposition well within the inner sublittoral zone of the shallow sea. Cushman (1933) found the foraminiferal fauna of the Moodys Branch to be similar to that on the present shallow shelf of the Indian Ocean. Rainwater (1957)

described the Moodys Branch environment as "shallow marine, in a rapidly transgressing sea over non-marine beds."

THE OSTRACODA OF THE UPPER MARL MEMBER

Fifty-three species were found in the upper marl and there is none that is exclusive to this unit. There are, however, two species that have terminal ranges in this member. They are *Bairdoppilata* sp. (Howe and Chambers) and *Cushmanidea alta* (Blake). There are also a few species which begin at this level and range upward. They are:

Argilloecia subovata n. sp.
Buntonia morsei (Howe and Pyeatt)
Cytherella sp. Howe and Chambers
Cytheropteron lanceolata n. sp.
Loxoconcha yazooensis n. sp.
Paracypris licina n. sp.

PALEOBATHYMETRY OF THE UPPER MARL MEMBER

The ostracod fauna of the upper marl suggests a depositional environment of slightly deeper water than the greensand below. This is evidenced by numerous specimens of the genera *Actinocythereis, Brachycythere, Buntonia, Bythocypris, Cytherella, Cytherelloidea, Cytheropteron, Haplocytheridea, Paracypris* and *Trachyleberis* which are more characteristic of the deeper water clays. There are still present, however, a considerable number of specimens of *Absonocytheropteron, Clithrocytheridea, Cyamocytheridea, Hermanites, Opimocythere, Paracytheridea* and *Tropidocythere* which generally are more typical of the sands and marls of the shallower environments. The largest percentage of Foraminifera (over 82%) belongs to the genera *Bolivina, Cibicides, Quinqueloculina, Sigmomorphina* and *Uvigerina* with significant numbers of *Eponides* and *Textularia.* The planktonic species are much less than ten percent. This assemblage has considerable similarity to that described for the middle half-intermediate open marine (middle neritic, 20m to 100 m ±) environment by the New Orleans Paleoecologic Committee of the Gulf Coast Section of SEPM (1966). It is suggested that the upper marl member of the Moodys Branch formation was deposited at depths exceeding those of the greensand below but not exceeding the midsublittoral range. This unit represents a rapid deepening of the transgressing Jackson sea.

TABLE 1. Relative Abundance of Some Common Small Foraminiferal Genera in the Jackson Group in Mississippi

Genus	Moodys Branch Formation		Yazoo Clay Formation					
			West-Central and Central Counties		Eastern Counties			
	Greensand %	Upper Marl %	Lower Beds %	Upper Beds %	North Twistwood Creek Clay%	Cocoa Sand %	Pachuta Marl %	Shubuta Clay %
Angulogerina		0.5			0.18		0.8	0.1
Anomolina		2.0	3.3					0.5
Articulina	2.7							
Bitubulogenerina					0.2			
Bolivina	1.2	15.9	5.2	0.8	6.2	2.1	3.9	1.0
Bulimina			0.4		0.1		0.4	15.4
Buliminella					0.1			
Cancris							0.4	2.3
Cassidulina		1.2	0.3				1.4	
Cibicides	9.7	21.6	23.5	0.5	11.1	29.8	15.2	9.2
Dentalina				0.3	0.1		0.6	1.2
Discorbis	1.3	0.5			7.4	5.7	0.4	
Entosolenia					0.2			
Epistomina				0.3				1.1
Eponides	2.6	3.3	1.7	0.3	0.4		4.5	1.1
Frondicularia			0.1					
Gaudyrina								3.0
Glandulina					7.3			
Globigerina		3.6	1.65	11.0	5.3		16.3	15.4

TABLE 1. (Continued) Relative Abundance of Some Common Small Foraminiferal Genera in the Jackson Group in Mississippi

Genus	Moodys Branch Formation		Yazoo Clay Formation					
			West-Central and Central Counties		Eastern Counties			
	Greensand %	Upper Marl %	Lower Beds %	Upper Beds %	North Twistwood Creek Clay %	Cocoa Sand %	Pachuta Marl %	Shubuta Clay %
Globorotalia			0.05		0.26			1.1
Globulina	3.8		0.2				0.4	0.05
Gumbulina			0.1					
Guttulina			0.3				1.3	0.05
Gyroidina			0.15					
Hantkenina			0.05				0.5	2.5
Lagena					0.14		0.5	
Marginulina			0.05		7.0		1.6	1.05
Massalina	11.2	0.5	0.1		0.8			1.0
Miliola	25.8							
Nodosaria			0.1					0.1
Nonion	1.2		0.7		5.6	14.4	3.6	
Nonionella			0.3		23.5	29.7		
Planulina								2.1
Polymorphina					0.46	2.0		
Pullenia			0.05					0.2
Quinqueloculina	19.5	12.2	2.2		2.5	3.4		0.05
Reussella	2.8							

TABLE 1. (Continued) Relative Abundance of Some Common Small Foraminiferal Genera in the Jackson Group in Mississippi

Genus	Moodys Branch Formation		Yazoo Clay Formation					
			West-Central and Central Counties		Eastern Counties			
	Greensand %	Upper Marl %	Lower Beds %	Upper Beds %	North Twistwood Creek Clay%	Cocoa Sand %	Pachuta Marl %	Shubuta Clay %
Robulus		2.0	1.6	4.3	0.20		5.3	4.4
Rotalia							0.4	0.2
Saracenaria								0.1
Sigmorphina	1.3	16.3	0.3		0.1		0.6	
Siphonina	8.5		8.8	7.8	12.1	7.2	9.5	2.3
Spiroloculina	2.6							
Textularia	2.6	4.1	4.6	11.6	16.0	1.7	14.2	5.5
Triloculina	1.3		0.1		0.32			
Uvigerina	1.2	16.3	44.1	55.3	0.24	4.0	18.2	29.0
Others	0.7							

THE YAZOO FORMATION IN YAZOO, MADISON, HINDS, RANKIN AND SCOTT COUNTIES

GENERAL

In the above stated counties the Yazoo is not differentiated into mappable units. In Yazoo County, however, Mellen (1940) recognized two lithofacies which he simply termed a lower facies and an upper facies. He described the lower facies as approximately three hundred fifty feet thick and, in general, composed of "fairly homogeneous, silty, calcareous, fossiliferous, gummy, plastic montmorillonitic clay." He described the upper facies as being about one hundred fifty feet thick and composed of "relatively pure beds of massive, gummy, noncalcareous montmorillonitic clay, beds of interlaminated silt and silty clay; a thin bed of bentonite, and lentils of limestone." In Madison County Priddy (1960) did not recognize smaller units in the Yazoo formation and reported it to be homogeneous clay except for several thin limestones in the upper fifty foot interval. He stated that "when fresh the Yazoo is a blue-gray, slightly silty, fairly calcareous, massively bedded clay . . . " In Hinds County Moore (1965) did not differentiate the Yazoo into member units and described it generally as a "fairly homogeneous unit consisting of blue-green to blue-gray, calcareous, fossiliferous clay with some pyrite." In Scott County Bergquist (1942) used the terms "lower beds" and "upper beds" to differentiate the parts of the Yazoo section from which he obtained his microfaunal specimens.

In the wedge-shaped outcrop trend the Yazoo formation is thickest in Yazoo County and thins eastward reaching its thinnest part in eastern Wayne County near the Alabama line. Mellen (1940) reported a thickness of approximately five hundred feet from borings and outcrops along the Yazoo River in Yazoo County. Priddy (1960) reported a thickness range in Madison County from three hundred sixty to four hundred feet. Moore (1965) reported an average thickness of about four hundred fifty feet in the subsurface area around the Jackson Dome. Bergquist (1942) estimated the total thickness of the entire formation in Scott County, south of Morton, Mississippi, to be about three hundred forty feet. This would indicate a thickness of the Yazoo formation of approximately three hundred twenty feet. DeVries (1963) noted the varying thicknesses of the Yazoo mem-

ber units in Jasper County and the maximum thickness of these members combined is approximately two hundred eighty feet. The total thickness of all members combined in eastern Wayne County probably does not exceed one hundred fifty feet.

The original type section of the Yazoo formation as defined by Lowe (1915) is a bluff on the Yazoo River on the concave side of a large meander of the river. It is located within Yazoo City in the southern part of the city 175 yards south of Holmes Street. Thirty years ago it was an excellent exposure of the lower part of the Yazoo formation but now it is very badly weathered and slumped and most of it is under a thick and almost impenetrable cover of undergrowth. The following description is only an approximation of this section.

Description	Feet	Thickness Feet
Top of loess bank on Ridge Road	Elev. 342.0	
Loess		50.0 (estimated)
Silt, massive, buff to brown, argillaceous	15.0	
Cover	35.0	
Citronelle formation (?) (Both upper and lower contacts are under cover)		25.0 (estimated)
Cover	25.0	
Yazoo formation (contact under cover)		120.0 (estimated above roadbed of Hwy. 3)
Cover	25.0	
Clay, grayish-buff, badly slumped and weathered, limonite-stained, silty, calcareous, slightly fossiliferous	12.0	
Cover	12.0	
Clay, grayish-buff, badly slumped and weathered, limonite-stained, calcareous, slightly fossiliferous	18.0	
Cover	30.0	

Clay, grayish-green fresh, weathers buff, badly weathered, blocky, calcareous, slightly fossiliferous 23.0

Roadbed of Mississippi Highway 3, 175 yards south of Holmes Street ....Elev. 147.0 (from topo map)

Cover to edge of water in channel of Yazoo River 73.0

The Mississippi Geological Economic and Topographical Survey drilled a stratigraphic test through the Yazoo formation near the outcrop of the type section and spot cores of this formation were taken every twenty feet throughout an interval starting at a depth of forty feet and extending to one hundred eighty feet. (See Fig. 5.)

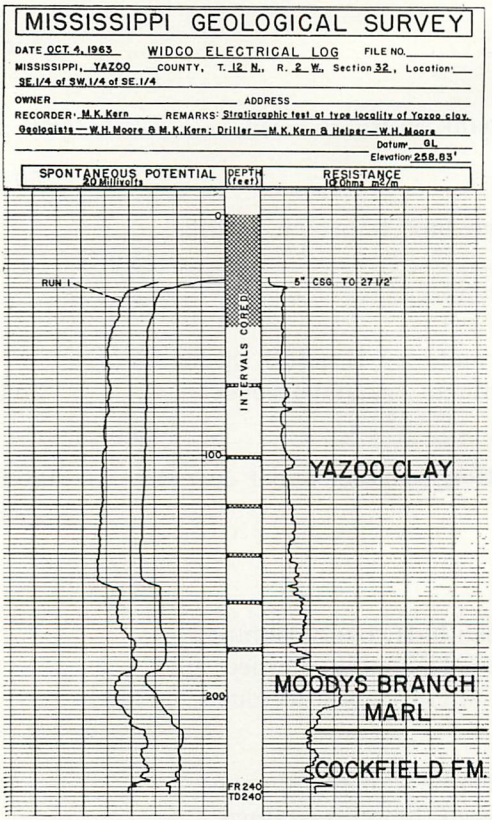


Figure 5.—Electrical log of stratigraphic test drilled at type locality of Yazoo formation, Yazoo City, Mississippi, SE¼, SW¼, Sec. 32, T12N, R2W, Yazoo County, Mississippi. The hole was drilled to test the Yazoo, Moodys Branch and Cockfield formations.

CONTACTS

THE YAZOO AND FOREST HILL FORMATIONS CONTACT

The contact between the Moodys Branch and the Yazoo formations has been described, supra.

Mellen (1940) reported that in Yazoo County the Yazoo clay "conformably overlies the Moodys Branch marl and conformably underlies the Forest Hill sand" and said that "beds of interlaminated silt and silty clay indicate the transitional relationship with the Forest Hill member and the Jackson." Priddy (1960) described the contact in Madison County between the badly leached Yazoo and the Forest Hill as transitional and difficult to recognize along the edge of the Forest Hill outline in T7N, R1E but considered the "cross-bedded silty clays" as Forest Hill and "the lower featureless strata" as Yazoo. He described the contact in road cuts in less rugged terrain and along narrow ridge crests as being observable where "sands or silts overlie freshly exposed calcareous Yazoo clay."

Moore (1965) noted that the Yazoo-Forest Hill contact in Hinds County is "not sharp and can be placed usually only within a few feet." Bergquist (1942) placed the contact in Scott County at a thin bentonite layer at the top of the Yazoo. In Jasper County the stratigraphically contemporaneous Forest Hill sand and the marine Red Bluff clay intertongue. DeVries (1963) described this interfingering relationship in test hole JF as follows:

> . . . this interval consists of 91 feet of dark, gray-brown or greenish-brown, silty, sandy, glauconitic clays interrupted by two massive, clayey sand units 14 and 26 feet thick which contain lignite and glauconite. The clayey sand units, regarded as Forest Hill, are in the upper half of the Forest Hill-Red Bluff interval and are separated by 25 feet of glauconitic, clay. These are interpreted to be extensions of "deltaic tongues" into a pro-deltaic environment.

He also pointed out that in Hole JK the "sand (Forest Hill) rests in sharp, probably erosional, contact with the dark-green fissile clay-shales of the uppermost Shubuta clay member." He described the contact as "conformable and transitional where the Shubuta was in contact with the Red Bluff clay." In Clarke and Wayne counties the contact relations between the Yazoo formation and the overlying units are discussed under the Shubuta clay member heading, infra.

THE OSTRACODA

Fifty-one species of ostracods were found in the lower beds and forty-two species were found in the upper beds of the Yazoo formation in this area. The species which were found to occur only in the lower beds are:

Argilloecia sp. (very rare)
Buntonia levinsoni n. sp. (very rare)
Cytheromorpha asperata n. sp.
Echinocythereis aff. E. nuda Puri
Loxoconcha cocoaensis Krutak
Monoceratina mucronata n. sp.
Monoceratina sp. (very rare)

Several other species which were found to have ranges that terminate in the lower beds of this region are:

Actinocythereis nodosa n. sp. (very rare)
Clithrocytheridea grigsbyi (Howe and Chambers)
Cytheromorpha calva Krutak
Cytheropteron lanceolata n. sp.
Hermanites hysonensis (Howe and Chambers)
Konarocythere spurgeonae (Howe and Chambers)
Occultocythereis broussardi (Howe and Chambers)
Trachyleberis montgomeryensis bispinosa n. subsp.

The species which were found to occur only in the upper beds in this region are:

Acanthocythereis howei n. sp.
Cytherella sylverinica Howe and Law
Cytherelloidea cocoaensis Krutak
Hermanites collei (Gooch) (very rare)
Murrayina sp. (very rare)

Haplocytheridea ehlersi (Howe and Stephenson) and *Phractocytheridea ouachitensis* (Stephenson) are also more characteristic of the upper beds even though they occur locally in the lower beds.

PALEOBATHYMETRY

The lower and upper beds of the Yazoo formation are considered together since the fauna and the lithology are similar. The ostracod genera most characteristic of the Yazoo forma-

tion, in general, are the spinose types such as *Actinocythereis, Acanthocythereis, Echinocythereis, Henryhowella* and *Trachyleberis* and the relatively smooth-shelled types such as *Argilloecia, Brachycythere, Bythocypris, Cytherella, Cytheropteron, Cytheromorpha, Digmocythere, Haplocytheridea, Paracypris* and *Phractocytheridea.*

Benson (1959) lists *Bythocypris* and *Cytheropteron* as two of the genera characteristic of his Biofacies IV (deeper water zone) and *Brachycythere, Cytherella* and *Paracypris,* among others, as characteristic of his Biofacies II which he described as a "shallow shelf with fine sands and silts." They also more nearly correspond to the open shelf, middle to outer neritic (beyond 15 fathoms) zone of Curtis (1960) and the open Gulf offshore biofacies (30 - 100 fathoms) of Engel and Swain (1967).

The most abundant foraminiferal genera of the lower beds are: *Bolivina, Cibicides, Siphonina, Textularia* and *Uvigerina* which is *very abundant.* (See Table 1.) This assemblage has much in common with that described for the middle shelf intermediate open marine (20m to 100m) of the New Orleans Paleoecologic Committee (1966) and station 5 (450 feet below sea level) depth of Loep (1965). The most abundant foraminiferal genera of the upper beds are: *Globigerina, Marginulina, Siphonina, Textularia* and *Uvigerina* which is very abundant. The considerable increase in *Globigerina* and *Uvigerina* and decrease in *Cibicides* and *Textularia* may suggest slightly greater depths of deposition for the upper beds. It is suggested that the lower beds were deposited at depths in the approximate range of midsublittoral to inner part of the outer sublittoral zone and the upper beds were deposited well within the outer sublittoral zone.

The Yazoo formation is considered by Bornhauser (1947) to be the inundative phase of a normal three-phase marine cycle although the regressive phase is not well developed in Mississippi. Rainwater (1957) has also recognized the deeper depositional environment of the Yazoo. He suggested the depth range to be middle to outer neritic. From comparisons of the Jackson Ostracoda and Foraminifera with their Recent counterparts it is suggested that the maximum depth of the Jackson inundative phase was reached during deposition of the upper part of the Yazoo formation.

THE YAZOO FORMATION IN JASPER, CLARKE AND WAYNE COUNTIES

In the above counties the member units of the Yazoo formation, as described by Cooke (1933) and Murray (1947) (1963), are recognizable lithologically. Thus, each member will be discussed as a separate unit for this area.

NORTH TWISTWOOD CREEK CLAY MEMBER

GENERAL

Murray (1947) described the North Twistwood Creek clay member from exposures in Jasper County near Rose Hill, Mississippi, as ". . . green or gray, slightly glauconitic, fossiliferous clay with an average thickness of forty feet . . ." DeVries (1963) described it in other localities in Jasper County as consisting of "greenish-gray to greenish-brown, fossiliferous, silty, calcareous, plastic clays and grayish-brown, sparingly fossiliferous, silty clays. The lower six to seven feet contain abundant glauconite . . ."

The type area of the North Twistwood Creek clay member is now largely under cover, badly slumped and weathered, thus only an approximate measurement of this section can be made. The section measured begins near the bottom of a hill at an indurated ledge in a ditch on the east side of a road cut on State Highway 18 and extends southwestward up a hill to a point near the top. Near the top of the hill the measurement was continued from exposures in a pasture on the east side of the road. The top of the hill is approximately two and one-half miles southwest of Rose Hill, Mississippi. The description is as follows:

Description	Feet	Thickness Feet
Soil and vegetal cover (in pasture) ----		4.0
Clays and sands, gray to brown, silty with limestone concretions scattered about on top ----------	4.0	
North Twistwood Creek clay member		35.0 (estimated)
Clay, grayish-green fresh, weathers gray to buff, blocky, calcareous,		

slightly fossiliferous, limestone concretions near top. (This describes exposures in a pasture near the top of a hill 2.5 miles from Rose Hill) 6.0 (approx.)

Cover ..... 10.0 (approx.)

Clay, gray to buff, badly weathered and slumped, blocky, slightly glauconitic, fossiliferous, in road ditch ..... 5.0 (approx.)

Cover ..... 14.0 (approx.)

Moodys Branch formation (?)

Limestone ledge, indurated, limonite-stained, badly weathered 1.0

The contact between the Moodys Branch formation and the North Twistwood Creek clay member is very questionable here because of the slump and cover. Most of the exposures are confined to gullies in a pasture near the top of a hill on the southeast side of Mississippi Highway 18. (See Fig. 6.)

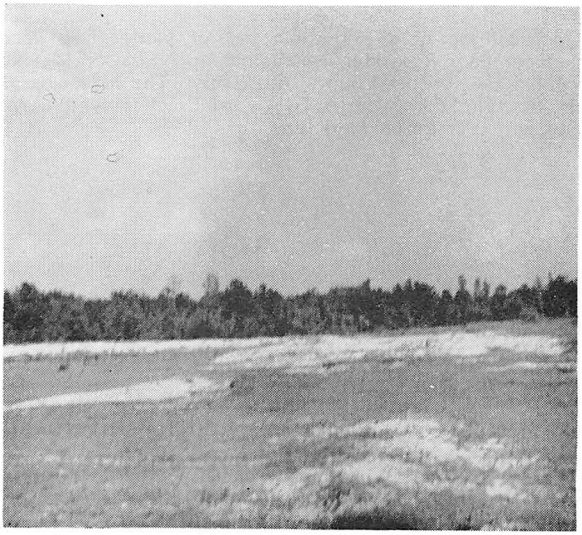


Figure 6.—Exposure of North Twistwood Creek clay in the North Twistwood Creek clay member type area just east of State Highway 18 approximately two and one-half miles west of Rose Hill, Mississippi.

The Mississippi Geological Economic and Topographical Survey drilled a stratigraphic test of this section on the northwest side of Highway 18 and the electrical log is shown in Figure 7.

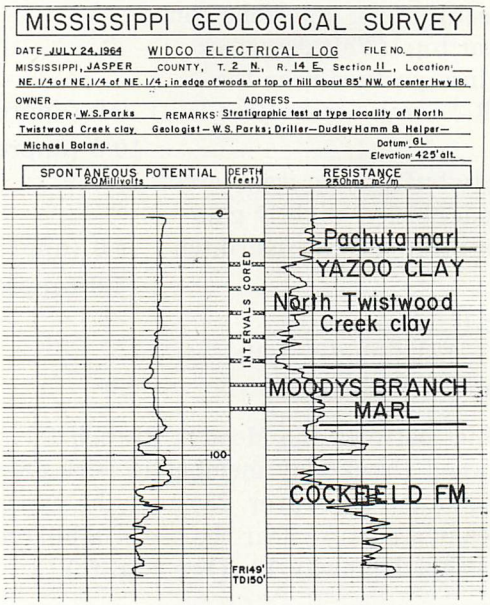


Figure 7.—Electrical log of stratigraphic test of North Twistwood Creek clay member near Rose Hill, Mississippi, in NE¼, NE¼, NE¼, Sec. 11, T3N, R12E, Jasper County, Mississippi. The hole was drilled through the Pachuta marl, North Twistwood Creek clay, the Moodys Branch and part of the Cockfield formation.

Farther east in Clarke County near Pachuta, Mississippi, the North Twistwood Creek clay member was sampled from exposures on the bluffs of Pachuta Creek. (See Fig. 8.) In general, these clays are grayish-green when fresh, weathering to gray or buff, calcareous, micaceous and fossiliferous. The lower part of the section was sampled from exposures on Garland Creek near Shubuta, Mississippi, and these clays are slightly more glauconitic than those of the middle and upper parts of the section.

One of the best exposures of the North Twistwood Creek clay is on the south bluff of Shiloh Creek near Shiloh Creek bridge in the SW¼ Section 18, T10N, R5W in northeastern Wayne County. (See Fig. 9.) This section may be described as follows:

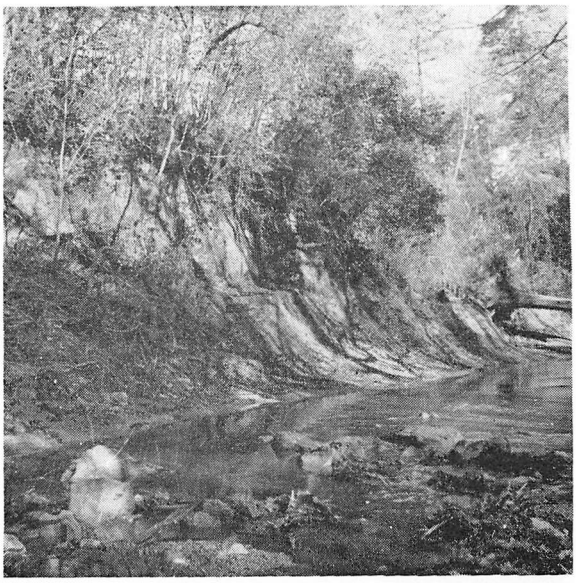


Figure 8.—Exposure of the North Twistwood Creek clay member in the bluffs of Pachuta Creek near Pachuta, Mississippi, in SW¼, Sec. 3, T1ON, R16E, Clarke County, Mississippi.

Description	Thickness Feet	Feet
Cocoa sand member (measured to top of creek bluff only)		13.0
Sands, red to yellow, silty, colluviated and badly weathered (partly under cover)	9.0	
Covered by slump	4.0	
North Twistwood Creek clay member		11.5
Claystone ledge, semi- indurated, weathers gray, calcareous, slightly glauconitic	1.0	
Clay, grayish-green fresh, weathers gray to buff, silty, calcareous, micaceous, fossiliferous with small thin bands of claystone concretions in lower part	5.5	

Clay, grayish-green fresh, weathers gray, blocky, gummy, fossiliferous.... 5.0

Edge of water of channel of Shiloh Creek ..... Elev. (?)

Figure 9.—Exposure of the North Twistwood Creek clay member in the bluffs of Shiloh Creek near Shiloh Creek Bridge in SW¼, Sec. 18, T1ON, R5W, Wayne County, Mississippi. The cap is approximately on the line of contact between the North Twistwood Creek clay and the Cocoa sand.

Another good exposure of the North Twistwood Creek clay member was found on the banks of Bucatunna Creek at Frost Bridge approximately three and one-half miles from Shiloh Creek. This section is located about 150 yards upstream on the north side of the bridge over Bucatunna Creek at Frost Bridge. At this point the Creek channel narrows and forms a rapids over the clay bottom. (See Figs. 10 and 11.) This section may be described as follows:

Description	Thickness Feet	Feet
Soil and vegetal cover		5.0
Cover	2.0	

Sand and clay, gray to brown, silty, badly slumped and weathered	3.0	
North Twistwood Creek clay member		10.0
Clay, grayish-green fresh, weathers gray, slightly silty, micaceous, fossiliferous	2.0	
Claystone ledge, semi-indurated, gray, calcareous, silty	0.3	
Clay, grayish-green fresh, weathers gray, slightly silty, micaceous and fossiliferous	3.0	
Claystone ledge, semi-indurated, calcareous, silty	0.7	
Clay, grayish-green fresh, weathers gray, blocky, micaceous, fossiliferous	4.0	
Edge of water of channel of Bucatunna Creek		Elev. (?)

Figure 10.—Exposure of the North Twistwood Creek clay member in channel and banks of Bucatunna Creek just north of "Frost Bridge" over Bucatunna Creek in SW¼, Sec. 29, T1ON, R5W, Wayne County, Mississippi.

Figure 11.—Exposure of the North Twistwood Creek clay member in the bluffs of Bucatunna Creek approximately 150 yards upstream north of "Frost Bridge" over Bucatunna Creek in SW¼, Sec. 29, T1ON, R5W, Wayne County, Mississippi.

Still farther east in Choctaw County, Alabama, the North Twistwood Creek clay member was well exposed at one time on the west bank of Keyser Hill on Choctaw County Road 14 six miles west of Gilbertown, Alabama. It is now essentially all under cover.

In Jasper County, DeVries (1963) reported the North Twistwood Creek clay to vary in thickness from nineteen to forty-three feet. The stratigraphic test at the type area near Rose Hill indicated approximately forty-seven feet. Farther west in Clarke County at Barnett, Mississippi, the stratigraphic test in the Pachuta marl type area indicated approximately fifty-eight feet of North Twistwood Creek clay. (See fig. 12.) This additional thickening may be associated with faulting. Tourtelot (1944) mapped a zone of east-west trending faults in the Quitman and Pachuta area.

CONTACTS

The contact between the Moodys Branch formation and the North Twistwood Creek clay member has already been discussed. The upper contact of the clay and the Cocoa sand is gradational, probably through a large interval. This contact is arbitrarily placed, in Wayne County, at the top of a claystone ledge approximately one foot thick. The writer was unable to observe the contact zone of the North Twistwood Creek clay member and the Cocoa sand member at Keyser Hill, Alabama.

In Clarke and Jasper counties the Cocoa sand has wedged out and the North Twistwood Creek clay is in contact with the Pachuta marl. DeVries (1963) suggested that in Jasper County a lighter colored, less cohesive, sandy, greenish-tan, silty-clay facies in the upper five to seven feet may be a lateral counterpart of the Cocoa sand. In the stratigraphic test at Barnett, Mississippi, in western Clarke County, the contact is placed at the top of a zone described as "tan to gray fossiliferous clay with a few sand grains." No Cocoa sand equivalent is recognizable.

THE OSTRACODA

Sixty species of ostracods were found in the North Twistwood Creek clay member. Samples from the lower half of the section were separated from samples of the upper half in order to illustrate more accurately the points of range termination or beginning of some of the species. (See Table 2.) The North Twistwood Creek clay member is also essentially uniform lithologically except for the lower few feet which are more glauconitic and grade into the sands and marls of the Moodys Branch below. No species were found to be exclusive to this member, but there are a few species which have terminal ranges at this level. They are:

Cyamocytheridea hadleyi (Stephenson)
Hemicythere (?) *croneisi* n. sp.
Loxoconcha stavensis n. sp.
Paracypris licina n. sp.

There are also several species which begin in this member and range into higher strata. They are:

Absonocytheropteron watervalleyensis Krutak
Buntonia levinsoni n. sp.
Cushmanidea keyserensis Krutak
Cushmanidea papula Krutak
Echinocythereis aff. E. nuda Puri
Hazelina couleycreekensis (Gooch)
Loxoconcha cocoaensis Krutak
Loxoconcha watervalleyensis Krutak
Triginglymus gnythophoreous Krutak

PALEOBATHYMETRY

The largest percentage of ostracod specimens of the North Twistwood Creek clay belong to the genera *Actinocythereis, Argilloecia, Brachycythere, Buntonia, Bythocypris, Cytherella, Cytherelloidea, Cytheromorpha, Cytheropteron, Loxoconcha, Paracypris* and *Trachyleberis* which are the genera most characteristic of the clays. In contrast, however, to the Yazoo formation clays of the west-central counties there are also present in this member a large number of specimens belonging to such genera as *Clithrocytheridea, Cushmanidea, Cyamocytheridea, Hermanites* and *Tropidocythere*. There are less abundant occurrences of *Hemicythere* and *Paracytheridea*. These forms are generally more typical of the marls and sands of the Moodys Branch below and the Cocoa sand above. The environment of deposition as suggested by the ostracods of the North Twistwood Creek clay appear to have something in common with Benson's (1959) Biofacies II of the Todos Santos Bay shelf zone. *Cytherella sp.* Howe and Chambers is similar morphologically to *Cytherella banda* of the Todos Santos Bay. Both *Paracypris franquesi* Howe and Chambers and *Paracypris licina* n. sp. are abundant in the North Twistwood Creek clay and *Paracypris licina* n. sp. is very similar in morphology to *Paracypris pacifica* of the Todos Santos Bay shelf. Other North Twistwood Creek clay forms that are congeneric with some of the Todos Santos Bay shelf genera are *Brachycythere, Cytherura* and *Hemicythere*. The above assemblage also shows some similarity to the open shelf, middle to outer neritic zone of Curtis (1960) and the open Gulf offshore biofacies (30-45 fathom biofacies) of Engel and Swain (1967). In general, the ostracods of this member suggest a shallower water environment than equivalent age strata of the Yazoo for-

mation of the west-central counties. Apparently there was a slower deepening of the Jackson sea in the eastern region of the state. Bornhauser (1947) suggested that sedimentation in this region was influenced by a high during the Jacksonian stage.

Less depth in this region is also suggested by the foraminiferal genera. (See Table 1.) The most abundant foraminiferal genera found in the North Twistwood Creek clay are: *Bolivina, Cibicides, Discorbis, Glandulina, Globigerina, Nonion, Nonionella, Siphonina* and *Textularia* with less than 10% planktonic species. These genera are clearly within the middle shelf-intermediate open marine (20 m to 100 m) of the New Orleans Paleoecologic Committee (1966). Considerable abundances of *Cibicides, Nonionella* and *Textularia* occuring together are suggestive of an inner to midneritic range in Lowman's (1949) (fig. 13, p. 1954-1955) depth cross-section. Considering both the Ostracoda and the Foraminifera it is suggested that the North Twistwood Creek clay member was deposited in approximately the outer part of the inner sublittoral to the midsublittoral depth range.

THE COCOA SAND MEMBER

GENERAL

The original type section of the Cocoa sand member was defined by Cooke (1933) for beds cropping out near the old post office at Cocoa, Alabama, two and one-half miles east of Melvin, Alabama. This exposure is now under cover. Cooke (1933) described the Cocoa sand in Choctaw County, Alabama, in general, as "17-39 feet of fine yellow sand, partly calcareous and argillaceous, with shells in the lower part." Another section of the Cocoa sand in Choctaw County, Alabama, is located on "Slick" or Keyser Hill on Choctaw County Road 14, six miles west of Gilbertown, Alabama. At the time this section was first measured and sampled much of it was under cover and it was badly slumped. However, an approximate measurement was made and estimates of thicknesses of member units were recorded. At that time the section began at road level on the west end of a bridge on Choctaw County Road 14 and extended 0.2 miles westward to the top of Keyser Hill. It may be described as follows:

Description	Thickness Feet	Thickness Feet
(?) Terrace sands and soil (variable thickness)		6.0 - 8.0
Sand, fine to medium grained, colluviated, red to brown	6.0 - 8.0	
Cocoa sand member		26.0 (estimated)
Sand, fine grained, colluviated, white to buff	2.0	
Sand, fine grained, bluish-green fresh, weathers gray to buff, massive, argillaceous, micaceous, glauconitic, fossiliferous	16.0	
Sand, fine grained, colluviated, buff to brown, badly weathered	4.0	
Cover . . . (This cover conceals the contact of the North Twistwood Creek clay and the Cocoa sand)	4.0	
North Twistwood Creek clay member (contact concealed)		41.0 (estimated)
Cover	13.5	
Clay, grayish-green fresh, weathers gray, blocky, silty, micaceous and slightly fossiliferous	14.5	
Cover	13.0	
Road level at bridge on Choctaw County Road 14		Elev. (?)

Recent observations of the above section reveal that it is now essentially all under cover and of no further value as an alternate type section.

According to Cooke (1933) the thickness of the Cocoa sand in Choctaw County, Alabama, ranges from 17.0 to 70.0 feet.

Hendy (1948) described the Cocoa sand in northeastern Wayne County as "fine to medium sands argillaceous in the lower part and massive above . . . when fresh, the sand is a light bluish-gray but weathers to a white, yellow or red, massive sand." He also stated that it is about fifty feet thick in northeastern Wayne County and about twenty-five feet thick along Chickasawhay River. The writer has observed some exposures along the banks of the Chickasawhay River. There is approximately ten feet of Cocoa sand above the water level of the river at the Shubuta Hill locality with about three feet exposed near the water. The lithology and fauna are the same as they are at Keyser Hill, Alabama.

The Cocoa sand gradually pinches out toward western Clarke County and is not recognizable in the stratigraphic test at Barnett, Mississippi. As previously mentioned, DeVries (1963) suggested a possible lateral counterpart to the Cocoa sand in Jasper County in the upper five to seven feet of the North Twistwood Creek clay member.

CONTACTS

MacNeil (1946) stated that the Yazoo clay formation extends into Alabama "in two tongues separated by the Cocoa sand, the upper tongue containing *Basilosaurus* remains and the lower tongue underlain by the Moodys Branch formation." The lower tongue is the North Twistwood Creek clay and the upper tongue is the Pachuta marl.

The Cocoa sand-Pachuta marl contact at the Frost Bridge Road Y locality in Wayne County is placed at the bottom of an indurated limestone ledge immediately below which is a clean white sand which grades into glauconitic sand below. At the Shubuta Hill locality in Clarke County the contact is placed at the base of a gray, indurated, sandy, limestone ledge.

The Cocoa sand is not recognized as such either faunally or lithologically in the stratigraphic test hole at Barnett, Mississippi. The same is true for the stratigraphic test of the North Twistwood Creek clay farther west in the type area near Rose Hill.

THE OSTRACODA

Fifty-seven species of ostracods were found in the Cocoa sand. This member contains a diversified ostracod fauna. However, only a few species were found to be exclusive thereto. They are:

Acuticythereis cocoaensis Krutak
Cushmanidea serangodes Krutak
Cushmanidea sp. (very rare)
Pseudocytheromorpha sp. (very rare)
Triginglymus sp.

Two other species, *Cushmanidea keyserensis* Krutak and *Cushmanidea papula* Krutak are much more common in and characteristic of the Cocoa sand than in subjacent or superjacent strata.

Species which have ranges that terminate in the Cocoa sand are:

Absonocytheropteron carinata Puri
Actinocythereis grigsbyi (Howe and Chambers)
Basslerites sp. (very rare)
Clithrocytheridea shubutensis (Stephenson)
Cytherelloidea cocoaensis Krutak
Loxoconcha cocoaensis Krutak
Loxoconcha watervalleyensis Krutak
Paracypris franquesi Howe and Chambers
Triginglymus gnythophoreous Krutak
Triginglymus hyperochus Blake

PALEOBATHYMETRY

The ostracod fauna of the Cocoa sand contains numerous specimens of the genera *Actinocythereis, Buntonia, Bythocypris, Cytherelloidea, Cytheromorpha, Cytheropteron, Loxoconcha* and *Trachyleberis* which, in general, are probably more indicative of the outer shelf facies. On the other hand, there are also considerable numbers of specimens from such genera as *Absonocytheropteron, Clithrocytheridea, Cyamocytheridea, Cushmanidea, Hermanites, Opimocythere, Paracytheridea, Triginglymus* and *Tropidocythere* which are also prominent in the Moodys Branch greensand. These genera suggest a shallow water depositional

environment. *Bythocypris* and *Cytheropteron* are noted from Benson's (1959) Biofacies IV zone of the Todos Santos Bay region to be indicative of deeper water but the presence of such genera as *Brachycythere, Opimocythere, Paracytheridea, Cytherella* and members of the *Leguminocytheridae* family such as *Acuticythereis, Basslerites* and *Triginglymus* are more suggestive of the shallow shelf facies. In many respects the assemblage is related to the facies described by Curtis (1960) as the open lagoon (with small fluvial influence) but also contains several genera that are characteristic of her open shelf (inner to mid-neritic facies). The most abundant foraminiferal genera of the Cocoa sand are: *Cibicides, Discorbis, Nonion, Nonionella* and *Siphonina* which are somewhat similar to those of the North Twistwood Creek clay. These genera are suggestive of the middle shelf middle neritic environment of the New Orleans Paleoecologic Committee (1966) and the abundance of *Nonionella* suggests a depth approximately that of station 3 of Loep (1965). Again, the considerable numbers of *Cibicides, Nonion, Nonionella,* with some *Quinqueloculina* suggest a depth range, on Lowman's (1949) cross-section, of an inner to mid-neritic depth. Considering both Foraminifera and Ostracoda it is suggested that the Cocoa sand was deposited in a depth range that approximates the outer part of the inner sublittoral zone.

THE PACHUTA MARL MEMBER

GENERAL

This is the "*Pecten*-bryozoan" zone of the older literature. It also contains remains of "Zeuglodon" (*Basilosaurus cetoides* (Owen)). DeVries (1963) described the Pachuta marl in Jasper County as a "tan to light greenish-gray, very fossiliferous, sandy, glauconitic, argillaceous marl. In the sandy upper two or three feet of the member is a horizon rich in *Pecten* and bryozoan remains."

The type section was designated by Murray (1947) for exposures on Pachuta Creek one and one-half miles south of Pachuta, Mississippi, which he described as "6 to 25 feet of buff, gray or white, partially indurated, generally glauconitic, fossiliferous marl." A stratigraphic test was drilled through the Pachuta marl near the type section at Barnett in Clarke County,

Mississippi. The electrical log is shown in Fig. 12. This section is designated in this paper as the alternate type section since the surface outcrop of the Pachuta marl in the type area is badly weathered and under cover. The closest approach to a surface exposure of this member in the type area is on the east bank of a roadcut on U. S. Highway 11 near the south end of a bridge over Dry Creek one and one-half miles south of Pachuta, Mississippi. Only about five feet of Pachuta marl is exposed in this section. It may be described as follows:

Description	Feet	Thickness Feet
Soil and sand		3.0
Sand, fine to medium grained, colluviated, red to brown, silty, slumped and partly under cover	3.0	
Pachuta marl member		12.0 (estimated)
Marl, indurated, gray to ivory, sandy, glauconitic, *Pecten* and bryozoan remains present	5.0	
Cover (contact between the North Twistwood Creek clay member and Pachuta marl member under cover)	7.0	
Bottom of bank in roadcut		Elev. (?)

A much better section of the Pachuta marl was measured in northeastern Wayne County at a road Y approximately one and one-half miles west of the bridge over Bucatunna Creek at Frost Bridge, Mississippi. (See Figs. 13 and 14.) This section is exposed in a pasture on a hillside between forks of the road. It may be described as follows:

Description	Feet	Thickness Feet
Soil and vegetal cover		4.0
Sands and silts, reddish brown to dark brown, argillaceous, partly covered	4.0	

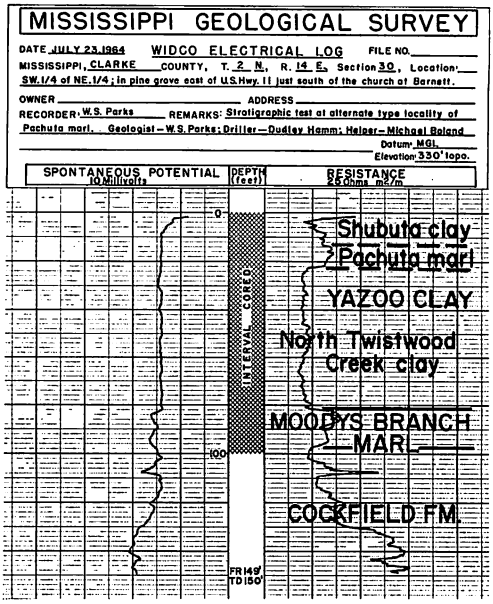


Figure 12.—Electrical log of stratigraphic test of Pachuta marl at Barnett, Mississippi, in SW¼, NE¼, Sec. 30, T2N, R14E, Clarke County, Mississippi.

Shubuta clay member 19.0

Clay, buff to tan, badly weathered and slumped, blocky, gummy, slightly fossiliferous, limestone concretions scattered about on surface 19.0

Pachuta marl member 12.0

Limestone ledge, indurated, gray to white, weathers ivory, slabby, sandy, glauconitic 1.5

Marl, semi-indurated, gray to buff, weathers ivory, sandy, glauconitic. Abundant *Pecten*, bryozoan remains in upper part 10.0

Limestone ledge, indurated, gray to white, weathers ivory, sandy, glauconitic 0.5

Cocoa sand member		15.0 (approx. to ditch at road Y)
Sand, fine to medium grained, white to ferruginous	3.0	
Cover to bottom of ditch at road Y	12.0	
Bottom of ditch at road Y		Elev. (?)

Figure 13.—Exposure of Pachuta marl in pasture between forks of a road Y in SW¼, Sec. 29, T1ON, R5W, Wayne County, Mississippi.

The lithology of the Pachuta marl is essentially the same throughout the above counties. It is therefore a good surface unit for mapping in this region.

In general, it can be described as a semi-indurated to indurated, sandy, glauconitic, very fossiliferous marl sandwiched between the underlying silty, greenish-gray to white colluviated sands of the Cocoa sand and the overlying blocky, grayish-green clays of the Shubuta clay.

In Jasper County DeVries (1963) reported the thickness of the Pachuta marl to range from fifteen to twenty-two feet. In the stratigraphic test near Rose Hill (Fig. 7) the thickness of

Figure 14.—Contact between Cocoa sand and Pachuta marl in outcrop of Pachuta marl at a road Y in SW¼, Sec. 29, T1ON, R5W, Wayne County, Mississippi. The upper part of the Cocoa sand is white colluviated sand and the ledge is an indurated sandy limestone ledge just below the "**Pecten**-bryozoan zone".

the Pachuta marl is approximately twelve feet and the same thickness was recorded in the stratigraphic test at Barnett (Fig. 12). At all the outcrop localities observed in Clarke and Wayne counties the thickness appeared to remain essentially constant at about twelve feet.

CONTACTS

The Pachuta marl is a relatively thin unit and is easily recognizable in Wayne, Clarke and Jasper counties. The contact between the Pachuta marl and the Shubuta clay is easy to determine in Wayne and Clarke counties because the upper "*Pecten*-brozoan" zone is a semi-indurated unit, not too variable in thickness, and usually forms a ledge or terrace in outcrop. There is also a distinct "kick" on an electrical log at the stratigraphic position of the Pachuta marl which makes it easily determinable in the shallow subsurface.

THE OSTRACODA

Sixty-nine species of ostracods were found in the Pachuta marl. No species were found to be exclusive to this unit but a large number of species were found to have ranges that terminated in this member. They are:

Buntonia morsei (Howe and Pyeatt)
Clithrocytheridea caldwellensis (Howe and Chambers)
Clithrocytheridea garretti (Howe and Chambers)
Cushmanidea keyserensis Krutak
Cushmanidea papula Krutak
Cyamocytheridea chambersi (Stephenson)
Cyamocytheridea watervalleyensis (Stephenson)
Cytheretta alexanderi Howe and Chambers
Cytheromorpha asperata n. sp.
Cytheromorpha calva Krutak
Cytheromorpha ouachitaensis Howe and Chambers
Cytheropteron lanceolata n. sp.
Cytherura moorei n. sp.
Eucythere undet. spp. A. and B.
Hermanites collei (Gooch)
Hermanites hysonensis (Howe and Chambers)
Hermanites melleni n. sp.
Konarocythere spurgeonae (Howe and Chambers)
Loxoconcha yazooensis n. sp.
Monoceratina alexanderi Howe and Chambers
Occultocythereis sp.
Opimocythere mississippiensis (Meyer)
Paracytheridea belhavenesis Howe and Chambers
Phractocytheridea lirata n. sp. (questionable occurrence)
Tropidocythere carinata n. sp.

Other species that begin their ranges in the Pachuta marl and extend into the Shubuta clay are:

Acanthocythereis howei n. sp.
Bairdia hiwanneensis Howe and Lea
Cytherella hannai Howe and Lea
Cytherella sylverinica Howe and Law
Eucythere aff. E. woodwardensis Howe
Krithe hiwanneensis Howe and Lea
Phractocytheridea ouachitensis (Stephenson)
Pterygocythere murrayi Hill

Hazelina couleycreekensis (Gooch) occurs rarely above and below the Pachuta marl and is very characteristic of this unit.

PALEOBATHYMETRY

The largest number of ostracod specimens in the Pachuta marl belong to the genera *Actinocythereis, Argilloecia, Bairdia, Buntonia, Bythocypris, Cytherella, Cytheropteron, Digmocythere, Haplocytheridea, Henryhowella, Phractocytheridea* and *Trachyleberis*. The spinose and relatively smooth-shelled types are more abundant and give the ostracod fauna of the Pachuta marl a similarity to that of the Yazoo clays in the west-central area. There are major differences, however, because some of the same genera which are more characteristic of and widespread in the sands and marls of some of the lower stratigraphic units have ranged into the Pachuta marl. These include representatives of *Clithrocytheridea, Cushmanidea, Cyamocytheridea, Hermanites, Opimocythere, Paracytheridea* and a few representatives of *Tropidocythere*. In addition, *Hazelina*, which is so common in the Pachuta marl, is similar morphologically to *Hermanites* and other similar genera which are common in the sands and marls. There is a greater diversity of species in the Pachuta marl than in any other stratigraphic unit of the Jackson group. This diversity and abundance of fauna is suggestive of open marine conditions but makes it difficult to determine the depths of deposition within the marine environment.

The ostracod fauna, as a whole, is again suggestive of the open shelf, middle to outer neritic, described by Curtis (1960). Some of the ostracod genera of the Pachuta marl may also be found in the list of diagnostic genera for open Gulf offshore biofacies (both the 30-45 fathom and the 45-100 fathom subfacies of Engel and Swain (1967)).

The most abundant foraminiferal genera are: *Cibicides, Globigerina, Robulus, Siphonina, Textularia* and *Uvigerina*. This combination of genera, especially the notable increase in *Globigerina* and *Uvigerina*, (See Table 1) suggests a deeper water environment than that in which the underlying members were deposited. This assemblage of Foraminifera approximates the mid-neritic to outer neritic range of depths in the cross-section

of Lowman (1949). Considering both the Ostracoda and the Foraminifera it is suggested that the Pachuta marl was deposited at depths that range from the midsublittoral to inner part of the outer sublittoral zone.

SHUBUTA CLAY MEMBER

GENERAL

DeVries (1963) described the Shubuta clay in Jasper County as "light greenish-gray, calcareous to non-calcareous, glauconitic, fossiliferous, silty clays." He described the weathering as "tan to yellowish-gray and shows a mottling of the two colors or shades of them. Selenite (gypsum) crystals are formed as a by-product of weathering and are particularly prominent at exposures of the upper one-third of the Shubuta clay."

Murray (1947) designated the Shubuta clay member for exposures in gullies on the east side of Chickasawhay River beginning just north of old Highway 45 bridge near Shubuta, Mississippi, in Clarke County. (See Figs. 15 and 16.) He proposed it for "20 to 250 feet of clays and clayey marls, underlain by the Pachuta marl and overlain by the Forest Hill sand or Red Bluff clay of the Oligocene." This section is badly slumped and weathered and a large portion of it is under cover but an approximate description is as follows:

Description	Feet	Thickness Feet
Top of hill		Elev. 263.0 feet
Red Bluff Clay (both upper and lower contacts are under cover)		10.0 (estimated)
Cover	10.0	
Shubuta clay member (upper contact under cover)		86.0 (estimated)
Cover	24.0	
Clay, grayish-green fresh, weathers gray to buff, blocky, plastic, calcareous, fossiliferous, limestone concretions cover part of slope	62.0	
Pachuta marl member		12.0

Marl, semi-indurated, gray to ivory, very sandy, glauconitic with abundant *Pecten* and bryozoan casts; forms a terrace at the Shubuta clay contact	8.0	
Marl, indurated, gray to buff, very sandy, glauconitic, with echinoids; forms a prominent ledge	2.0	
Marl, indurated, gray to buff, very sandy, glauconitic; forms two prominent ledges	2.0	
Cocoa sand member		10.0 (exposed above edge of river channel.)
Cover and slump	7.0	
Sand, fine grained, dark bluish-green fresh, weathers gray to reddish brown, glauconitic, argillaceous	3.0	
Edge of channel on the east bank of the Chickasawhay River		Elev. 145.0

The upper few feet of the Shubuta clay is well exposed below an excellent section of Red Bluff clay on the east bluff of a meander in the Chickasawhay River. This section is located in Sec. 28, T1ON, R7W, Wayne County and approximately one mile southwest of Hiwannee, Mississippi. It is described as follows:

Description	Thickness Feet	Feet
Soil, sand and vegetal matter near top of bluff		4.0
Sand, reddish-brown, silty, argillaceous, humus in upper part, partially covered	4.0	
Red Bluff formation		18.5

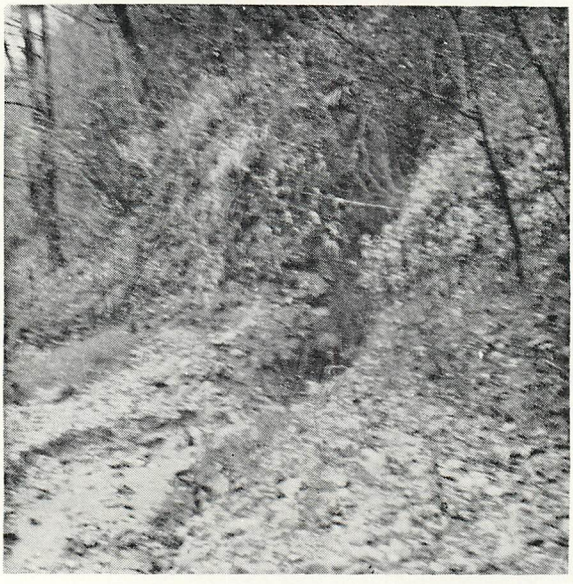


Figure 15.—Entrance to gully of the Shubuta clay type locality which begins at the edge of the channel of Chickasawhay River just beneath the bridge on old U. S. Highway 45 near Shubuta, Mississippi. This gully proceeds eastward about 1300.0 feet up Shubuta Hill and exposes the upper Cocoa sand, Pachuta marl and Shubuta clay members and part of the Red Buff clay formation.

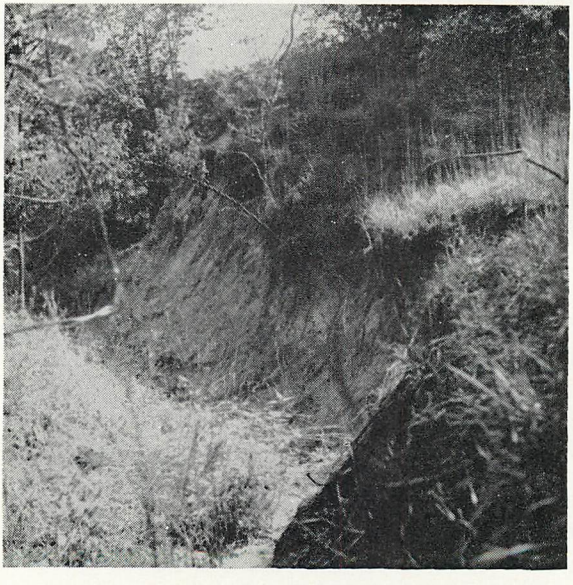


Figure 16.—Exposures of Shubuta clay (about the middle of the section) in a gully on the Shubuta clay type locality referred to in figure 15.

Ledges of iron concretions, red to brown, sandy, variable size, occurring in three layers	1.0	
Clay, dark green fresh, weathers dark gray to red, silty, glauconitic, highly fossiliferous	5.5	
Ledge of iron concretions, red to brown, sandy	0.5	
Clay, dark green fresh, weathers gray to dark red, silty, glauconitic and highly fossiliferous	3.0	
Ledge of iron concretions, red to brown, sandy	0.5	
Clay, dark green fresh, weathers gray to red, silty, glauconitic, fossiliferous	1.0	
Ledge of iron concretions, red to brown, sandy	0.5	
Clay, dark green fresh, weathers gray to red, silty, glauconitic, highly fossiliferous	6.0	
Ledge of iron concretions, red to brown, sandy	0.5	
Shubuta clay member		3.0 (exposed above channel of Chickasawhay River)
Clay, grayish-green fresh, weathers buff, blocky, calcareous, plastic, fossiliferous	3.0	
Edge of water in Chickasawhay River channel		Elev. (?)

At this locality the slumping clays and iron concretions from the Red Bluff outcrop have almost dammed the Chickasawhay River causing the channel to become very narrow and form rapids.

DeVries (1963) recorded a thickness range for the Shubuta clay in Jasper County from one hundred to two hundred sixteen feet. Hendy (1948) reported the range from ninety feet along the Chickasawhay River to approximately thirty-five feet in northeastern Wayne County. It is safe to state that the total thickness of all Yazoo formation members in this area probably does not exceed one hundred fifty feet.

CONTACTS

The contact between the Shubuta clay member and the overlying Red Bluff clay or Forest Hill sand in Jasper County has been previously discussed.

MacNeil (1946) described the contact between the Shubuta clay and the overlying Red Bluff clay in Wayne and Clarke Counties as disconformable. Hendy (1948) has noted the contrast between the olive-green clays of the Shubuta and the dark-gray clays of the Red Bluff.

The writer has observed this contact in the section on the Chickasawhay River near Hiwannee, Mississippi. In some places small borings extend down into the Shubuta clay and these are filled with glauconitic clay. The contact is disconformable.

THE OSTRACODA

The samples in the upper half of the Shubuta clay section were separated from those of the lower half to illustrate more accurately the terminal or beginning points of some of the species. (See Table 2.)

Forty-nine species of ostracods were found in this member and only *Haplocytheridea ehlersi* (Howe and Stephenson) and *Murrayina sp.* are exclusive to this member. A few species have ranges that terminate in the lower part. These are:

Cytherella sp. Howe and Chambers
Cytherella undet. sp. B.
Cytherelloidea montgomeryensis Howe
Eucythere aff. E. woodwardensis Howe
Hazelina couleycreekensis (Gooch)

Loxoconcha inornata n. sp.
Monoceratina mucronata n. sp.
Murrayina sp. (very rare)

There are also several species such as *Acanthocythereis howei* n. sp., *Pterygocythere murrayi* Hill, *Alatacythere ivani* Howe and *Krithe hiwanneensis* Howe and Lea which occur very rarely below the Shubuta clay and are much more characteristic of the Shubuta clay than of other units. Still other forms characteristic of this member are: *Buntonia smithi* n. sp., *Cytherella hannai* Howe and Lea, *Cytherella insculptilla* n. sp., *Digmocythere russelli* (Howe and Lea) and *Phractocytheridea ouachitensis* (Stephenson).

PALEOBATHYMETRY

The most characteristic ostracod genera in the Shubuta clay member, in general, are: *Acanthocythereis, Actinocythereis, Argilloecia, Bairdia, Buntonia, Bythocypris, Cytherella, Cytheropteron, Digmocythere, Haplocytheridea, Henryhowella, Loxoconcha, Phractocythereidea, Pterygocythere* and *Trachyleberis.* The spinose and smooth-shelled forms are most abundant as noted for the upper beds of the Yazoo formation in the central and west-central counties. These genera suggest a deeper water facies than the ostracod suites of the units below. It is noted from Benson and Coleman (1963), Engel and Swain (1967) and Curtis (1960) that the genus *Pterygocythereis* (which is very similar to *Pterygocythere* in this paper and may be the same genus) was found to be diagnostic of the relatively deeper portion of the neritic or shelf zone. Engel and Swain (1967) also list representatives of *Krithe, Actinocythereis, Cytheropteron* and *Paracypris* as abundant and specimens of *Buntonia* and *Cytherella,* not so abundant, among others as diagnostic of their open Gulf offshore biofacies (45-100 fathom subfacies). All of these genera are present in the Shubuta clay.

The foraminiferal study shows *Bulimina, Cibicides, Globigerina, Textularia* and *Uvigerina* comprising 75% of the foraminiferal genera with *Bulimina, Globigerina* and *Uvigerina* comprising 60%. (See Table 1.) There are also small percentages of *Cibicides, Globorotalia* (planktonic), *Gaudyrina, Hantkenina* (planktonic), *Marginulina, Planulina, Robulus, Siphonina* and others. Many of these genera such as *Uvigerina, Bulimina, Plan-*

ulina, Gaudyrina and *Cibicides* have certain species, among others, that are listed as diagnostic of the outer shelf-outer neritic (100 m to 200 m ±) zone of the New Orleans Paleoecologic Committee (1966). Bandy (1956) listed *Planulina, Robulus, Uvigerina* and *Bolivina* as abundant and diagnostic of his "Fauna 5" zone which has a depth range from 251 feet to 600 feet. When the Ostracoda and Foraminifera are considered together it is suggested that the Shubuta clay was deposited in water depths approximating the outer sublittoral range.

This means that the deeper deposits of the Yazoo formation did not occur until Shubuta times in the eastern part of the state. This is some evidence to confirm Bornhauser's suggestion of a submarine high in this part of the state during a part of the Jacksonian stage.

CORRELATION OF THE JACKSON GROUP MEMBERS IN MISSISSIPPI

GENERAL

The species that are common to all the stratigraphic units of the Jackson group in Mississippi and may be considered "characteristic Jackson ostracods" are the following:

Actinocythereis boldi n. sp.
"Archicythereis" yazooensis (Howe and Chambers)
Brachycythere watervalleyensis Howe and Chambers
Buntonia shubutaensis Howe
Cytherella sp. A.
Cytherelloidea montgomeryensis Howe
Echinocythereis jacksonensis (Howe and Pyeatt)
Haplocytheridea montgomeryensis (Howe and Chambers)
Henryhowella florienensis (Howe and Chambers)
Hermanites dohmi (Howe and Chambers)
Loxoconcha jacksonensis Howe and Chambers
Trachyleberis montgomeryensis (Howe and Chambers)

In addition to the above forms, *Bythocypris* (?) *gibsonensis* Howe and Chambers occurs in all units except the Cocoa sand member; *Cytherella sp. B.* in all except the North Twistwood Creek clay member; *Cytheretta alexanderi* Howe and Chambers

and *Loxoconcha inornata* n. sp. in all except the Shubuta clay member. (See Table 2.) These species seem to bridge the varying lithofacies and have the longest ranges within the Jackson group. Although not all of the aforementioned species are necessarily confined to Jackson sediments, if a fossiliferous sample containing all of the above-named species is examined, it is safe to conclude that the sample came from some unit of the clastic Jackson group of Mississippi or Alabama.

MOODYS BRANCH FORMATION

The Moodys Branch formation is easily correlated across the state both lithologically and faunally. Most of the ostracods of the Riverside Park alternate type locality may be found at the Garland Creek section. Only a few species occur exclusively at one or the other localities. The Moodys Branch is one of the best mapping units of the Paleogene. (See Fig. 17.)

YAZOO FORMATION

None of the member units of Cooke and Murray is recognizable per se in the central and west-central counties. A general correlation can be made between the lower beds of the Yazoo formation in the central and west-central counties and the lower members (North Twistwood Creek clay through the Pachuta marl) of the eastern counties. There are a few species that occur areally across the state with ranges that terminate in the lower beds of the west-central counties and range no higher than the Pachuta marl in the eastern counties. These are:

Cytheromorpha asperata n. sp.
Cytheromorpha calva Krutak
Cytheromorpha ouachitaensis Howe and Chambers
Cytheropteron lanceolata n. sp.
Hermanites hysonensis (Howe and Chambers)
Konarocythere spurgeonae (Howe and Chambers)
Loxoconcha cocoaensis Krutak

The range of *Clithrocytheridea grigsbyi* (Howe and Chambers) terminates in the lower beds and this species occurs very rarely above the Pachuta marl in the east.

An age correlation can also be made between the upper beds (facies) of the Yazoo formation of the central and west-central

counties and the Shubuta clay member of the eastern counties. *Acanthocythereis howei* n. sp. occurs only in the upper beds in the central and west-central counties and rarely below the Shubuta clay in the east. *Haplocytheridea ehlersi* (Howe and Stephenson) does not occur below the Shubuta clay in the eastern counties and is more widespread and characteristic in the upper beds than it is in the lower beds of the central and west-central counties. Still another species, *Cytherella sylverinica* Howe and Law, does not occur below the upper beds of the central and west-central counties and ranges from the Pachuta marl through the Shubuta clay in the eastern counties. Other species which are more characteristic of the Shubuta clay and upper beds than they are of the lower strata are *Buntonia smithi* n. sp., *Cytherella insculptilla* n. sp. and *Phractocytheridea ouachitensis* (Stephenson). Another observation worthy of mention concerns the curvilinear rows of pits which are the primary distinguishing feature of the abundant species *Haplocytheridea montgomeryensis* (Howe and Chambers). They are more pronounced on the specimens of *H. montgomeryensis* from the upper beds of the central counties and the Shubuta clay of the eastern counties than on specimens from lower strata of the Jackson group. (See Fig. 17 for correlation summary.)

THE JACKSONIAN STAGE IN ADJACENT GULF STATES

The ostracods of the Jackson group in Mississippi include nearly all of the species reported from the Louisiana Jackson. The forms described by Howe and Chambers (1935) are from the part of the Jackson of Louisiana which is the approximate age equivalent of the Moodys Branch formation through the Pachuta marl member of Mississippi. Since there is a greater variety of facies represented by the member units in Mississippi more species have been found in the Mississippi Jackson than are reported from Louisiana. Monsour (1948) has suggested that the Shubuta clay may be missing from the surface in Louisiana and "possibly replaced by approximately fifty feet of non-fossiliferous, locally very silty, non-calcareous clays, lying above the Satartia bentonite of the upper Yazoo of Mellen."

The Moodys Branch is traceable into Texas as the "*Nonionella cockfieldensis* zone" but no ostracod correlations are made. Underlying Claiborne group formations in Texas such as

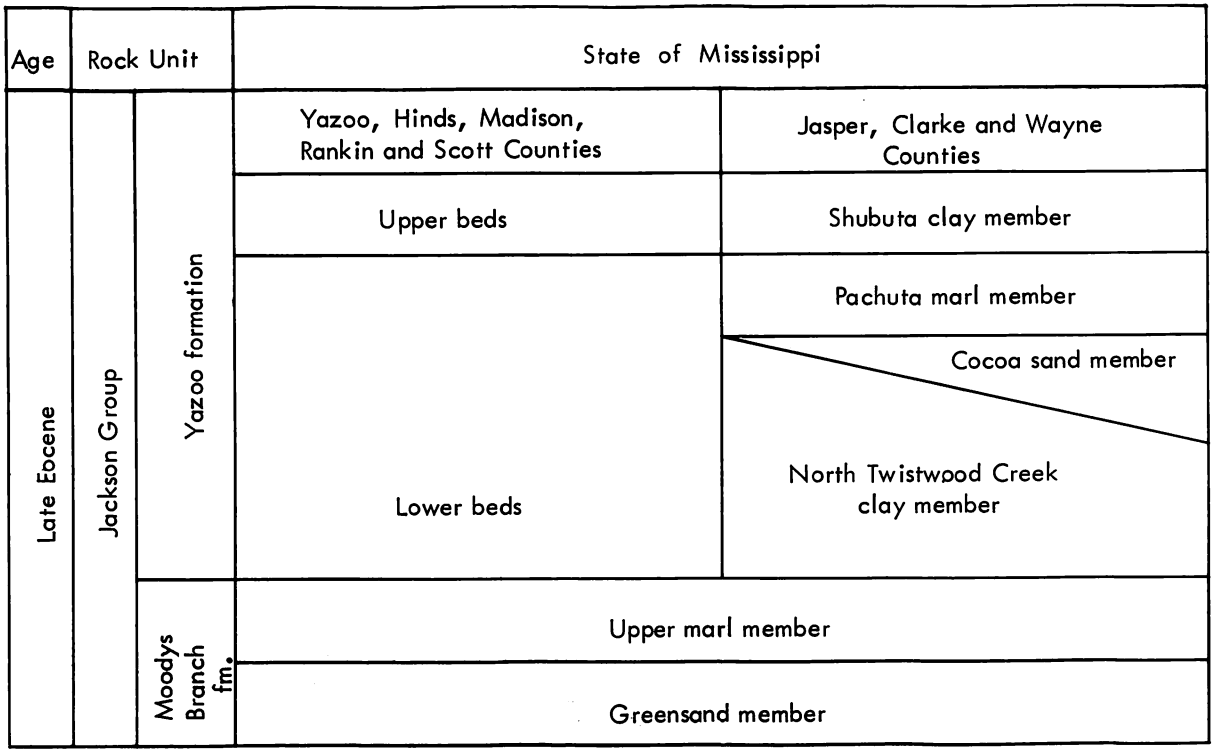


Figure 17.—Correlation of Jackson group in Mississippi.

the Reklaw and Weches have yielded many ostracod species which are conspecific with the Jackson of Mississippi. *Clithrocytheridea caldwellensis* (Howe and Chambers), *Clithrocytheridea garretti* (Howe and Chambers), *Haplocytheridea montgomeryensis* (Howe and Chambers) and *Paracypris franquesi* Howe and Chambers are conspecific species. Many other Claiborne and Jackson forms are closely related.

The ostracods of the Moodys Branch formation in Mississippi and those reported by Blake (1950) from the Gosport sand (Claiborne) of Little Stave Creek in Clarke County, Alabama, also show several species in common. Of the twenty-seven species described by Blake, nearly half are conspecific with Moodys Branch ostracods of Mississippi. The faunal similarity also extends to the megafauna because Cooke (1939) thought at one time the Gosport sand and the Moodys Branch were age equivalents. This faunal correlation is to be expected, however, because the lithofacies, thus the environment of deposition, of the Gosport sand at Little Stave Creek is very similar to that of the Moodys Branch formation in Mississippi. Farther east, on the Alabama River, the Gosport becomes more nearly a shelly facies. E. T. Monsour (1948) suggested that bed 11 of Cooke's (1926a) section of the Ocala at Claiborne Bluff on the Alabama River is equivalent in age to the Moodys Branch.

The Jackson group is equivalent in age to the Ocala group in Florida. Vernon (1942) listed 15 species from the Ocala of Holmes and Washington Counties in Florida that are conspecific with species of the Mississippi Jackson. More recently, however, H. S. Puri (1957d) revised and updated the taxonomy of the ostracods and established faunal zones in the Ocala group in Florida. Only four species are now of the same name in the Florida Ocala and Mississippi Jackson but there are numerous species which are very closely related structurally and morphologically.

Brown (1958) reported 13 species of Jackson ostracods from Upper Eocene units in wells of the Coastal Plain of North Carolina and Pooser (1965) reported 15 species which are conspecific with species from the Mississippi Jackson from the Upper Eocene of South Carolina. (See Fig. 18 for general correlation of the Late Eocene.)

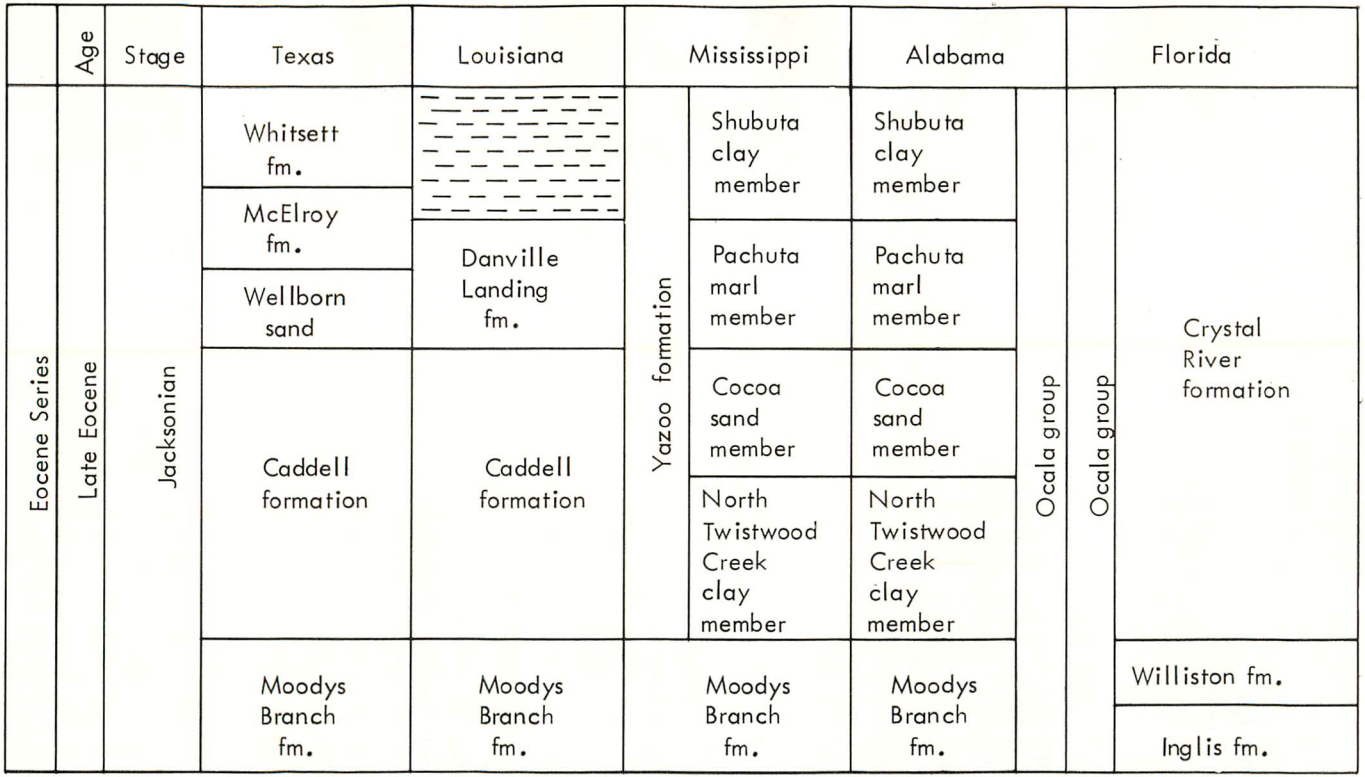


Figure 18.—Correlation of Jacksonion stage in adjacent Gulf states.

SYSTEMATIC PALEONTOLOGY

PREVIOUS WORK

As far as the writer can determine the first paper to illustrate ostracods from the Jackson Eocene of the Gulf Coast region is that of Otto Meyer (1887). Two ostracods were illustrated in connection with several megafossils which he described from the Tertiary of Alabama and Mississippi. The first really useful paper, however, was written by Howe and Law (1935) who described the ostracods of the Jackson of Louisiana. This was essentially a pioneer paper in initiating a systematic study of ostracods of the Gulf Coast Tertiary. Several more papers appeared during the thirties which described or listed ostracods which included one or more species from the Jackson group. These are works by Howe (1934b) (1936) (in Fisk, 1939), M. B. Stephenson (1936) (1937) (1938) and Monsour (1937). During World War II the works of Bergquist (1942), Murray and Hussey (1942) and Vernon (1942) appeared. Since World War II the papers have become much more numerous. One of the most productive ostracod workers is W. A. van den Bold who has done extensive biostratigraphic work in the Tertiary of the Caribbean. In his numerous works he listed several species of ostracods which are also found in the Jackson. See Bold (1946) (1950) (1957a) (1958) (1964) (1966) (1967). Harbans S. Puri (1957d) zoned the Ocala group with Ostracoda and Foraminifera and also described some Jackson species in his numerous taxonomic papers. See Puri (1952a, b) (1953) (1955) (1957c, d) (1958a, b). Many other papers have described some ostracods common to the Jackson or its age equivalents. These include papers by Swain (1946) (1951), Howe (1947a, c) (1951a), Weingest (1949), Sexton (1951), Wilbert (1953), Hill (1954), Krutak (1961), Deboo (1965), Laurencich (1969) and others.

Two fine papers that describe ostracods from Jackson age strata in the Carolinas are by Brown (1958) and Pooser (1965). Even some of the European and Russian workers have figured or listed a Jackson form from time to time. See Schweyer (1949), Grekoff (1956), Pokorny (1958), Mandelstam (1959), Kollman (1960) and Herrig (1966).

Many papers describing ostracods from the Claiborne group or equivalent strata have been helpful in this study. A few of

the important papers were written by Stadnichencko (1927), Murray (1938), Gooch (1939), Martin (1939), Sutton and Williams (1939), Murray and Hussey (1942), M. B. Stephenson (1942) (1944a) (1944b) (1946), Swain (1946) (1951), Blake (1950), Howe (1951b) and R. C. Howe (1963). Some of the more helpful papers on ostracods from the Paleocene or Early Eocene age sediments were written by Howe (1934a), Howe and Garrett (1934), Alexander (1934), M. B. Stephenson (1938), Kline (1943), Harris and Jobe (1951), Cheetham (1952) and Munsey (1953).

For this study the most useful paper that describes ostracods from the Oligocene or higher level is that of Howe and Law (1936) in which the ostracods of the Vicksburg group of Louisiana were described. Other papers found helpful were those by Howe and his graduate students (1935), Edwards (1944), Puri (1953a) (1956), McLean (1957), Swain (1946) (1951) and Butler (1963).

DESCRIPTION OF SPECIES

Insofar as necessary ostracods which were previously described from Jackson strata in Alabama, Mississippi and Louisiana have been reclassified to conform to recent taxonomic changes. Several juvenile forms were originally erected as distinct species, and in some cases, male and female forms of the same species were misinterpreted as different species. In all instances wherein a study of the forms has disclosed such errors, synonymies have been made with the proper species.

The orientation criteria used in this report is that of van den Bold (1946) which may be stated essentially as follows:

1. The carapace usually has an aerodynamic shape.
   a. If there is a pointed end, in side view, this end is posterior.
   b. If alae occur, the form is sagittate in dorsal view, and the arrowhead points to the anterior.
   c. Tubercles, large spines, and similar ornamentations point to the posterior.
2. The posterior end is usually widest in dorsal view, and the anterior end is highest in side view.
3. If a subcentral tubercle exists, it lies anterior to the middle, and is convex posteriorly.
4. The denticulation, or terminal series of spines, is stronger and better developed on the posterior end; those on the anterior end are shorter in order not to interfere with locomotion.

Dimorphic determinations were based primarily on the assumption that the carapace of the male is usually more elongate than the female.

All numbered holotypes, paratypes, plesiotypes and other figured specimens are in the Henry V. Howe Collection, Louisiana State University, Baton Rouge, Louisiana. See Plate 27 (in pocket) for geographic distribution of sample localities.

Subclass OSTRACODA Latreille, 1806

Order PODOCOPIDA Müller, 1894

Suborder PODOCOPINA Sars, 1866

Superfamily BAIRDIACEA Sars, 1888

Family BAIRDIIDAE Sars, 1888

Genus BAIRDIA McCoy, 1844

BAIRDIA HIWANNEENSIS Howe and Lea 1936

Pl. 1, figs. 1-4

Bairdia hiwanneenis Howe and Lea in Howe and Law, 1936, La. Dept. Cons. Geol. Bull. 7, p. 27, pl. 2, fig. 3; pl. 3, fig. 1; Howe, 1947, Jour. Paleo., vol. 21, p. 270; Bold 1950, Jour. Paleo., vol. 24, no. 1, p. 108, Bold, 1957, Micropaleontology, vol. 3, no. 3, p. 236; Mandelstam, 1959, VNIGRI Trans., vol. 136, Microfauna USSR, vol. 10, p. 453.

Diagnosis.—Male (?) carapace is smooth with the dorsal margin strongly and symmetrically arched. Posterior margin is acuminate with terminal point at the middle. Anteroventral margin is sharply convex but flattens out as it merges with the ventral margin. Female (?) carapace is smooth, subglobular in lateral view with dorsum very strongly convex and venter slightly convex. Right valve is denticulate along anteroventral and posteroventral margins.

Brief description of male (?)—Valve surface is smooth. Dorsal margin is symmetrically convex with highest point at center. Anteroventral margin is sharply convex but gradually flattens somewhat as it merges into the venter. The venter curves gradually upward toward the posterior forming an acuminate terminus at midposterior. Left valve overlaps right valve along dor-

sum and venter with the strongest overlap at venter. The muscle scar consists of seven to eight or more oval-shaped scars arranged irregularly in a subcircular cluster in the center of the valves. Hingement is adont.

Brief description of female (?).—Carapace is smooth, subglobular in lateral view. Dorsal margin is strongly convex and the highest point is at center. Ventral margin is slightly convex. Right valve is denticulate along anteroventral and posteroventral margins. Valve overlap is same as male (?). Posterior is acuminate at midpoint. Musculature and hingement are same as male (?).

Dimensions.—Plesiotype no. 5751, a complete male (?) carapace from the Shubuta clay member at locality 26: length 0.90 mm., height at mid-dorsum 0.57 mm. Plesiotype no. 5755, a female (?) left valve from the Shubuta clay member at locality 26: length 0.99 mm., height at mid-dorsum 0.66 mm.

Types.—All types are from the Shubuta clay member at locality 26.

Comparisons and remarks.—The subglobular forms always occur together with the more elongate forms and in approximately equal abundance. Therefore it is suggested that these two forms may be males and females of the same species. The female (?) specimens of this species are similar to *Bairdia woodwardensis* Howe and Law but differ in that the overlap of the left valve over the right valve along the dorsal margin is not as strong as in *B. woodwardensis.*

Occurrence.—In the Pachuta marl member: very rare to common at localities 26 and 29. In the Shubuta clay member: common at localities 26 and 29.

Genus BAIRDOPPILATA Coryell, Sample and Jennings, 1935

BAIRDOPPILATA sp. (Howe and Chambers) 1935

Pl. 1, figs. 5-7

Bairdia sp. Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 10, pl. 5, figs. 1, 2.

Diagnosis.—Carapace smooth, heavy, typically "bairdian" in outline. Venter is flattened to slightly concave. Dorsum has small peak at midpoint.

Brief description.—Carapace is smooth, heavy, and typically "bairdian" in lateral view. Dorsal margin is sharply convex forming a small peak at middorsum. Venter is flattened to slightly concave. Posterior is acuminate at midpoint. Margins are wide. Each anterodorsal and posterodorsal selvage area of the right valve contains a small, short taxodont series of teeth and each anterodorsal and posterodordal groove of the left valve contains a small, short taxodont series of teeth and sockets. Muscle scar consists of several oval-shaped scars arranged irregularly in a subcircular cluster in the center of each valve. Hingement is adont.

Dimensions.—Plesiotype no. 5757, a left valve from the Moodys Branch greensand at locality 24: length 1.03 mm., height at middorsum 0.66 mm.

Types.—All types are from the Moodys Branch greensand at locality 24.

Occurrence.—In the Moodys Branch greensand member: common at locality 10; very rare to rare at localities 12 and 24. In the upper marl member: common at locality 24.

Genus BYTHOCYPRIS Brady, 1880

BYTHOCYPRIS (?) GIBSONENSIS Howe and Chambers 1935

Pl. 2, figs. 1-3

Bythocypris (?) *gibsonensis* Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 9, 10, pl. 3, fig. 10; pl. 4, fig. 3; Howe and Law, 1936, La. Dept. Cons. Geol. Bull. 7, p. 27, pl. 1, figs. 34-37; Monsour, 1937, AAPG Bull., vol. 21, no. 1; Bergquist, 1942, Miss. Geol. Surv. Bull. no. 49, p. 105, pl. 11, fig. 3; Shimer and Shrock, 1944, *Index Fossils of North America*, pl. 287, figs. 64-66; Swain, 1946, Jour. Paleo., vol. 20, p. 375, pl. 54, figs. 4 a-e; McLean, 1947, Nat. Naturae, No. 200, p. 9; Puri, 1957, Fla. Geol. Surv. Bull. 38, p. 190, pl. 1, figs. 10-13; Marianos and Valentine, 1958, Micropaleontology, vol. 4, p. 365, pl. 1, figs. 3 a-c; text fig. 2; Bold, 1965, Micropaleontology, vol. 11, no. 4, p. 387, pl. 1, fig. 9.

Bythocypris sp. cf. B. gibsonensis Howe and Chambers in Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 43; Bold, 1946, *Contribution to the Study of Ostracoda*, Utrecht Univ., J. H. DeBussy, Amsterdam, p. 68, pl. 1, fig. 13.

Bythocypris gibsonensis Howe and Chambers in Bold, 1950, Jour. Paleo., vol. 24, no. 1, p. 108; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 11, fig. 14.

Bythocypris (?) *cf. B. gibsonensis* Howe and Chambers in Butler, 1963, La. Dept. Cons. Geol. Bull. 39, p. 39, pl. 1, fig. 1.

Diagnosis.—Carapace is smooth, elongate and subreniform in outline. Dorsum of both valves is arched with a small peak at middorsum of left valve. Venter is concave.

Brief description.—Carapace is smooth, elongate, subreniform in lateral view. Dorsal margin of both valves is arched with a small peak near middorsum of the left valve. Midventer is concave. Anterior margin is uniformly rounded; posterior margin is narrowly rounded, subacute. Left valve overlaps right valve slightly at dorsum and venter. Muscle scar consists of ten to twelve rounded scars arranged in a subcircular cluster near the center of each valve. Hingement is adont.

Dimensions.—Plesiotype no. 5760, a complete carapace from the Pachuta marl member at locality 29: length 0.97 mm., height 0.50 mm., thickness 0.41 mm.

Types.—All types are from the Pachuta marl member at locality 29.

Remarks.—Specimens from the Pachuta marl and Shubuta clay members are slightly larger than those at lower levels.

Occurrence.—In the Moodys Branch formation greensand member: common at localities 10 and 11; common to abundant at locality 12; very rare at locality 20; common at locality 22; and common to abundant at locality 24. In the upper marl member: abundant at localities 10, 11, 17, 22 and 24. In the Yazoo formation lower beds (facies) : abundant at localities 1, 6, 7, 11 and 17; common at locality 16. In the Yazoo formation upper beds (facies) : common at locality 9; abundant at localities 14, 15 and 18. In the North Twistwood Creek clay member: abundant at locality 22; very rare at locality 23; common to abundant at locality 25; rare at locality 28; common at locality 31. In the

Pachuta marl member: common at locality 20; common to abundant at localities 22, 26 and 29. In the Shubuta clay member: common to abundant at localities 21, 26, 27 and 29.

Superfamily CYPRIDACEA Baird, 1845

Family PARACYPRIDIDAE Sars, 1923

Genus PARACYPRIS Sars, 1866

PARACYPRIS FRANQUESI Howe and Chambers 1935

Pl. 2, figs. 4-7

Paracypris franquesi Howe and Chambers, 1935, La. Dept. of Cons. Geol. Bull. 5, pp. 10-11, pl. 3, fig. 13; pl. 4, figs. 15, 19; Garrett, 1936, Jour. Paleo., vol. 10, p. 786; Monsour, 1937, AAPG Bull., vol. 21, no. 1, p. 89; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 105, pl. 11, fig. 4; Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 63; Bold, 1946, *Contribution to the Study of Ostracoda*, Utrecht Univ., J. H. DeBussy, Amsterdam, p. 66, pl. 1, fig. 16; Stephenson, 1946, Jour. Paleo., vol. 20, p. 309, pl. 42, fig. 4; pl. 44, fig. 11; Bold, 1950, Jour. Paleo., vol. 24, no. 1, pp. 107, 108; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol., Bull. 19, p. 125; Brown. 1958. N. C. Dept. of Cons. and Dev., Div. of Min. Res. Bull. 72, p. 57, pl. 1, fig. 12; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 774, pl. 92, fig 1.

Diagnosis.—Carapace is smooth, very elongate, subpyriform in lateral view. Dorsal margin is arched forming an angular peak at the anterior cardinal angle. Venter is concave.

Brief description.—Carapace is smooth, very elongate and subpyriform in lateral view. Anterior margin is evenly rounded; posterior is long and acute. Dorsal margin is arched forming an angular peak at the anterior cardinal angle; venter is concave. Left valve overlaps right valve along all margins except the anterior.

On the inside, the valves are deep with broad marginal areas. The line of concresence lies near the outer margin. Radial pore canals are few and often branched. Muscle scar consists of a vertical, slightly arcuate row of four oval- shaped scars, convex anteriorly, with two scars slightly posterior to them. Hingement is adont.

Dimensions.—Plesiotype no. 5764, a complete carapace from the North Twistwood Creek clay member at locality 30: length 0.99 mm., height 0.39 mm.

Types.—All types are from the North Twistwood Creek clay member at locality 30.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 10; common at locality 11; very rare to common at locality 12; rare at locality 22; very rare to rare at locality 24. In upper marl member: common at locality 10; rare at locality 11; common at locality 17; very rare at locality 22; rare at locality 24. In the Yazoo formation lower beds (facies): rare to common at locality 1; rare at locality 5; common at localities 6 and 7; abundant at locality 11; common at localities 16 and 17. In the Yazoo formation upper beds (facies): common to abundant at locality 9; rare at locality 15. In the North Twistwood Creek clay member: rare at locality 20; common at locality 22; common to abundant at locality 23; common to abundant at locality 28; abundant at locality 30; rare to abundant at locality 31. In the Cocoa sand member: very rare at locality 26.

PARACYPRIS LICINA n.sp.

Pl. 2, figs. 8-12

Diagnosis.—Carapace is smooth, subsiliquose in lateral view. Dorsal margin has a small concavity at the anterior cardinal angle and the anterodorsum appears slightly upturned. Posterior margin is narrow, subacute.

Description.—Carapace is smooth, subsiliquose in lateral view. Dorsal margin is smoothly convex except for a slight concavity at the anterior cardinal angle. Anterodorsum appears slightly upturned. Ventral margin is straight to slightly concave. Anterior margin is obliquely rounded; posterior margin is narrow, subacute. Left valve overlaps the right around all margins with the strongest overlap along the dorsum and midventer. Greatest height is slightly anterior to middorsum.

On the inside, the valves are moderately deep with broad, depressed marginal areas. Radial pore canals are few, short, occasionally paired. The line of concrescence lies near the outer margin. Muscle scar consists of three or four subovate scars arranged in a vertical to oblique row with two scars slightly posterior to them. Hingement is modified adont with downturned

flange of anterodorsal area of left valve overlapping a corresponding concavity of the right valve. A narrow dorsal groove of the left valve receives the flange of the right valve. Dimorphism is not determined. Some specimens are thinner and more compressed than others and these may be the males.

Dimensions.—Holotype no. 5766, a complete carapace from the North Twistwood Creek clay member at locality 28: length 0.64 mm., height 0.30 mm.

Types.—Holotype no. 5766 and paratype nos. 5767, 5768, 5770 are from the North Twistwood Creek clay member at locality 28; paratype no. 5769 is from the North Twistwood Creek clay member at locality 30.

Comparisons.—This species resembles *Aglaiocypris enigmatica* Keij, 1957, but differs in carapace outline, especially at the anterodorsum which is slightly upturned in *P. licina.*

Etymology.—The name licina means "turned upward" which describes the appearance of part of the anterodorsal margin of the above described species.

Occurrence.—In the Moodys Branch upper marl member: common at locality 22. In the North Twistwood Creek clay member: common at locality 22; common at locality 25; common to abundant at locality 28; common at locality 30.

Family PONTOCYPRIDIDAE G. W. Müller, 1894

Genus ARGILLOECIA Sars, 1866

ARGILLOECIA SUBOVATA n. sp.

Pl. 3, figs. 1-6

Diagnosis.—Carapace is small, smooth, translucent and subfusiform in lateral view; subovate in end view. The highest point is slightly posterior to middorsum. Anterodorsal margin is slightly upturned and the posterior margin is subacute. Greatest thickness is in the middle.

Description.—Carapace is small, smooth, translucent, subfusiform in lateral view; subovate in end view. Dorsum is convex with the highest point slightly posterior to middorsum. Venter is straight to slightly concave. Anterodorsal margin is rounded and appears to be slightly upturned. Posterior margin is subacute. Right valve overlaps the left valve strongly along the midventer and slightly along the dorsal and posterior margins. Greatest thickness is in the middle.

On the inside, the valves are moderately deep with broad inner lamellae. Radial pore canals are numerous at the anterior, paired, and the line of concrescence forms a large U. Muscle scar appears to consist of three oval-shaped scars in a more or less vertical row with two small scars slightly anterior to them. Hingement is adont. Dimorphism is not determined.

Dimensions.—Holotype no. 5771, a complete carapace from the Shubuta clay member at locality 26: length 0.48 mm., height 0.23 mm., thickness 0.18 mm.

Types.—All types are from the Shubuta clay member at locality 26.

Comparisons.—*A. subovata* n. sp. differs from *A. subcylindrica* Alexander, 1934, in outline of the dorsal margin and in being less cylindrical in end view than *A. subcylindrica.* It differs from *A. hiwanneensis* Howe and Lea, 1936, in having a less acute posterior and less symmetrical arching of the dorsum than *A. hiwanneensis.* It differs from *A. alexanderi* Swain, 1940, in that the greatest height in *A. subovata* n. sp. is slightly postmedian whereas the greatest height in *A. alexanderi* is median. The posterior of *A. alexanderi* is also more acute.

Etymology.—The name subovata means "almost oval-shaped" which describes the end view of the carapace of this species.

Occurrence.—In the Moodys Branch upper marl member: very rare at locality 24. In the Yazoo formation lower beds (facies): rare at locality 16; very rare at locality 17. In the Yazoo formation upper beds (facies): rare to common at locality 14; rare at locality 15. In the North Twistwood Creek clay member: com-

mon to abundant at locality 23; common at locality 25; abundant at locality 28. In the Pachuta marl member: rare to common at locality 26; rare to common at locality 29. In the Shubuta clay member: common at locality 21; rare to common at locality 26; common at locality 27.

ARGILLOECIA sp.

Pl. 3, fig. 7

Remarks.—Only one specimen of this species was found in the Yazoo clay formation lower beds of Scott County at locality 16. It is figured for reference.

Dimensions.—Figured specimen no. 5775: length 0.43 mm., height 0.17 mm.

Superfamily CYTHERACEA Baird, 1850

Family BRACHYTHERIDAE Puri, 1954

Genus BRACHYCYTHERE Alexander, 1933

BRACHYCYTHERE WATERVALLEYENSIS

Howe and Chambers 1935

Pl. 3, figs. 8-11

Brachycythere watervalleyensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 46, 47, pl. 3, figs. 1, 2, 3, 5, 6; pl. 4, fig. 1; pl. 6, fig. 7; Garrett, 1936, Jour. Paleo., vol. 10, no. 8, p. 786; Monsour, 1937, AAPG Bull., vol. 21, no. 1, p. 90 (list); Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 109, pl. 11, figs. 21, 22; Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 43; Murray and Hussey, 1942, Jour. Paleo., vol. 16, no. 2, p. 179, pl. 28, figs. 2, 3; text fig. 2, figs. 5, 6; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. of Geol. Bull. 19, p. 124; Brown, 1958, N. C. Dept. of Cons. and Dev., Div. of Min. Res. Bull. 72, p. 60, pl. 2, fig. 1; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 782, pl. 91, fig. 1.

Brachycythere (Digmocythere) watervalleyensis Howe and Chambers in Morkhoven, 1963, *Post-Paleozoic Ostracoda, Their Morphology, Taxonomy and Economic Use*, Elsevier, p. 215.

Digmocythere watervalleyensis (Howe and Chambers) in Deboo, 1965, Geol. Surv. of Ala. Bull. 80, pl. 11, fig. 4.

Diagnosis.—Carapace is smooth, on some specimens slightly reticulate; strongly alate with each ala extending as a ridge across the inflated midventral zone and ending in the lower posteromedian zone with a blunt spine.

Brief description.—Carapace is smooth, transparent and on some specimens slightly reticulate. It is ovate-alate in lateral view. Typical ala consists of a strong ridge which extends across the inflated convex midventral zone and terminates in the lower posteromedian zone with a blunt, posteriorly directed spine.

On the inside, the valves are deep with broad marginal areas. Radial pore canals are numerous at the anterior, sometimes occurring in pairs and sometimes are branched. The line of concrescence coincides with the inner margin. Muscle scar consists of a vertical row of scars which includes a large irregularly shaped scar at the top, a pair of smaller oval-shaped scars, side by side, in the middle, and a large oval-shaped scar at the bottom. Anterior to these is a large V-shaped antennal scar. Hingement is hemiamphidont.

Dimensions.—Plesiotype no. 5777, a carapace from the Yazoo formation lower beds at locality 6: length 0.81 mm., height 0.46 mm., thickness 0.47 mm.

Types.—Plesiotype nos. 5776, 5778 are from the North Twistwood Creek clay member at locality 30.

Occurrence.—In the Moodys Branch greensand member: rare at locality 10; common to abundant at locality 12; very rare at locality 20; rare at locality 22; rare to common at locality 24. In the upper marl member: abundant at locality 10; common at locality 17; abundant at locality 22; common at locality 24. In the Yazoo formation lower beds (facies): common to abundant at locality 1; common at locality 2; common to abundant at localities 4, 5 and 6; common at locality 7; abundant at locality 11; common at localities 13, 16 and 17. In the Yazoo formation upper beds (facies): common to abundant at locality 9; rare at locality 19. In the North Twistwood Creek clay member: common at locality 20; rare at locality 22; common to abundant at locality 23; rare to abundant at locality 25; common at locality 28; rare to common at locality 30; rare at locality 31. In the

Cocoa sand member: common at localities 26 and 31. In the Pachuta marl member: common at localities 20 and 22; abundant at locality 26; rare to common at locality 29. In the Shubuta clay member: common at locality 21.

Genus ALATACYTHERE Murray and Hussey, 1942

ALATACYTHERE IVANI Howe 1951

Pl. 3, figs. 12-14

Cythereis (Pterygocythereis ?) alexanderi Howe and Law, 1936, La. Dept. Cons. Geol. Bull. 7, pp. 42, 43, pl. 4, fig. 23; pl. 5, fig. 5.

Alatacythere alexanderi (Howe and Law) in Murray and Hussey, 1942 Jour. Paleo., vol. 16, pp. 164-166, 168, 171, pl. 27, figs. 10, 11; text figs. 1, 2, 10.

Pterygocythereis (?) alexanderi (Howe and Law), in part, in Stephenson, 1946, Jour. Paleo., vol. 20, p. 306.

Alatacythere ivani (Howe) in Howe, 1951, Jour. Paleo., vol. 25, no. 4, p. 538; Howe, R. C., 1963, La. Dept. Cons. Geol. Bull. 40, p. 17, pl. 1, figs. 8, 9.

Pterygocythereis ivani (Howe and Law) in Hill, 1954, Jour. Paleo., vol. 28, pp. 814-815, pl. 98, fig. 4a; pl. 97, figs. 4 a-b; pl. 99, figs. 3 a-e; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 12, fig. 17.

Alatacythere ivani (Howe and Law) in Grekoff, 1956, French Pet. Inst., Sed. Div.; *Treatise on Invertebrate Paleontology (Q) Arthropoda*, 1961, pp. Q260, Q261, fig. 190; figs. 4 a-d.

Alatacythere ivani Howe in Brown, 1958, N. C. Dept. Cons. and Dev., Div. Min. Res. Bull. 72, p. 62, pl. 8, fig. 4; Pokorny, 1958, *Grundzüge Der Zoologischen Mikropalaontologie*, Band II; Pooser, 1965, Univ. Kans. Paleo. Contr. Art. 8, p. 32, pl. 18, figs. 9, 11.

Diagnosis.—Carapace is large, fragile and strongly alate. Anterior margin is compressed and fringed with two rows of flattened spines. Dorsum is straight with a row of flattened bladelike spines projecting from it. Ala is very strong and begins in the anteroventral zone and projects outward and back posteriorly terminating in the posteroventral region as a pronounced alate extension.

Brief description.—Carapace is large, fragile and strongly alate. Surface of the valve is smooth and pellucid. Anterior margin is broadly rounded, compressed, and fringed with two rows of flattened spines; dorsum is straight and decorated with several flat, thin, bladelike spines projecting from it; posteroventral

margin commonly has four to six round spines projecting from it. A strong blade-like ala begins in the anteroventral part of the valve and extends outward and back posteriorly terminating in the posteroventral area as a pronounced alate extension.

Muscle scar consists of a vertical row of four oval-shaped adductors with a U-shaped scar anterior to them. Hingement is hemiamphidont.

Dimensions.—Plesiotype no. 5779, a right valve from the Pachuta marl member at locality 29: length 0.96 mm., height 0.50.

Types.—All types are from the Pachuta marl member at locality 29.

Occurrence.—In the Moodys Branch formation greensand member: very rare at localities 12 and 24. In the upper marl member: very rare at locality 16. In the Pachuta marl member: very rare at locality 29. In the Shubuta clay member: rare to common at locality 26.

Genus PTERYGOCYTHERE Hill, 1954

PTERYGOCYTHERE MURRAYI Hill 1954

Pl. 3, figs. 15-18

Alatacythere alata (Bosquet) in part, in Murray and Hussey, 1942, Jour. Paleo., vol. 16, no. 2, p. 171, pl. 27, figs. 13, 16, 18; text fig. 1, figs. 11-18.

Brachycythere alata (Bosquet) in part, in Stephenson, 1946, Jour. Paleo., vol. 20, p. 332, pl. 44, figs. 12, 13, 24, 25; pl. 45, fig. 26.

Pterygocythere murrayi Hill, 1954, Jour. Paleo., vol. 28, pp. 822, 823, pl. 100, figs. 5 a-c; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 11.

Pterygocythereis (Pterygocythere) murrayi Hill in Morkhoven, 1963, *Post-Paleozoic Ostracoda, Their Morphology, Taxonomy and Economic Use*, Elsevier, p. 218.

Diagnosis.—Carapace is large, thick-shelled, smooth and pellucid. Anterior margin is compressed; commonly has a delicate carina that extends around the anteroventral part. A strong blade-like ala extends outward and back posteriorly from anteroventer to midventer where it terminates with a strong spine. Another small, flat subtriangular spine is present on the posterior inward swing of the ala.

Brief description.—Carapace is large, thick-shelled, strongly alate and elongate-ovate in lateral view. Surface of the valves is smooth and pellucid. Dorsum is gently convex; venter is slightly sinuate. Anterior margin is compressed and commonly has a delicate carina that extends around the anteroventral part. Posterior margin is subtruncate with three to four large round spines projecting from the posteroventral part. A strong blade-like ala begins in the anteroventral part of the valve, extends out and back posteriorly and terminates with a strong spine in midventer. There is also another small, blade-like, flat sub-triangular spine present on the posterior inward swing of the ala. Muscle scar consists typically of one vertical row of four scars with one scar slightly anterior to the middle of the vertical row. Farther anterior to these, and slightly above, is a heart-shaped scar with a smaller scar below. Hingement is hemiamphidont.

Dimensions.—Plesiotype no. 5784, a complete carapace from the Shubuta clay member at locality 26: length 1.10 mm., height 0.60 mm., thickness (between tips of ala) 0.84 mm.

Types.—All types are from the Shubuta clay member at locality 26.

Occurrence.—In the Pachuta marl member: very rare at locality 29. In the Shubuta clay member: common to abundant at locality 26.

Genus DIGMOCYTHERE Mandelstam, 1958

DIGMOCYTHERE RUSSELLI (Howe and Lea) 1936

Pl. 4, figs. 1-3

Brachycythere russelli Howe and Lea in Howe and Law, 1936, La. Dept. Cons. Geol. Bull. 7, pp. 41, 42, pl. 2, figs. 30, 31; pl. 3, figs. 23-25; Murray and Hussey, 1942, Jour. Paleo., vol. 16, no. 2, p. 178, pl. 28, figs. 1, 4, 5, 8; text fig. 1, figs. 19-24; Shimer and Shrock 1944, *Index Fossils of North America*, p. 688, pl. 289, figs. 23-27; Bold, 1946, *Contribution to the Study of Ostracoda*, Utrecht Univ., J. H. DeBussy, Amsterdam, pp. 107, 108, pl. 8, fig. 8; Stephenson, 1946, Jour. Paleo., vol. 20, p. 333, pl. 44, fig. 22; pl. 45, fig. 19; Hill. 1954, Jour. Paleo., vol. 28, p. 812, pl. 97, figs. 1 a-b.

Brachycythere watervalleyensis Howe and Chamhbers, in part, in Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pl. 3, fig. 4.

Digmocythere russelli (Howe and Lea) in Abushik, Mandelstam et al, TRUDI, VNIGRI, Trans. vol. 150, *Microfauna of the USSR, Part 9*, pp. 277, 278; Howe, R. C., 1963, La. Dept. Cons. Geol. Bull. 40, p. 18, pl. 1, figs. 14, 15; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 11, fig. 16; Pooser, 1965, Univ. Kans. Paleo. Contr. Art. 8, p. 33, pl. 18, figs. 3, 5-7; Bold, 1967, Technologie, p. 8.

Diagnosis.—Carapace is large, heavy, alate and subovate in lateral view. Surface is smooth and white. A strong ala extends around the inflated portion of the valves from the anteroventer to the posteromedian zone. Two small blunt spines are occasionally present near the terminus of the ala.

Brief description.—Carapace is large, alate, subovate in lateral view. Surface of the valves is translucent, white and smooth. Dorsum of the left valve is strongly arched but slightly flattened along the hinge line. An ala begins in the anteroventral part of the valve and extends outward and backward posteriorly around the inflated midventer and terminates in the posteromedian region. On some specimens two small blunt spines are present near the terminus of the ala. The muscle scar generally consists of a vertical row of three pairs of scars as follows: a small round pair at top, two larger ovate or round scars, obliquely arranged, in the middle, and a pair of small round scars at the bottom. There is also a large V-shaped scar anterior to these with a smaller oval-shaped scar below it. Hingement is weakly paramphidont. The right valve anterior tooth is only slightly crenulate. Males are more elongate than females.

Dimensions.—Plesiotype no. 5786, a female left valve, from the Shubuta clay member at locality 26: length 1.27 mm., height 0.79 mm.

Types.—All types are from the Shubuta clay member at locality 26.

Occurrence.—In the Moodys Branch greensand member: common at localities 10, 11, 12, 20, 22 and 24. In the upper marl member: common at localities 10 and 11; rare at locality 22; rare to common at locality 24. In the Yazoo formation lower beds (facies) : rare at locality 16. In the Yazoo formation upper beds (facies) : common at locality 9. In the Pachuta marl mem-

ber: common at localities 20 and 22; common to abundant at locality 26; common at locality 29. In the Shubuta clay member: common to abundant at locality 26; common at locality 27; abundant at locality 29.

Genus OPIMOCYTHERE Hazel, 1968

OPIMOCYTHERE MISSISSIPPIENSIS (Meyer) 1887

Pl. 4, figs. 4-8

Cythere mississippiensis Meyer, 1887, Senckenbergische Nat. Ges. Frankfurt, "Bereicht", p. 14, pl. 2, figs. 20, 20a, 20b.

Brachycythre mississippiensis (Meyer) in Krutak, 1961, Jour. Paleo., vol. 35, no. 4, pp. 781, 782, pl. 91, fig. 10; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 12, fig. 16.

Opimocythere mississippiensis (Meyer) 1887 by Hazel, 1968, Jour. Paleo., vol. 42, no. 1, p. 116.

Diagnosis.—Carapace is large, alate, thick-shelled, tumid and coarsely reticulate on inflated portions. A typical ala is composed of a steep ridge which extends across the midventral inflated portion and branches into two ridges before reaching midventer. The upper ridge terminates with a blunt node in the posteromedian zone and the lower ridge terminates near midventer. There are several smaller subparallel ridges across the bottom of the carapace.

Brief description.—Carapace is large, thick-shelled, tumid; it is coarsely reticulate on inflated portions. Carapace is strongly alate in dorsal view; it is ovate in lateral view. A typical ala is composed of a steep ridge which curves across the midventral inflated zone and branches into two ridges just before reaching midventer. The larger upper ridge terminates with a blunt node in the lower posteromedian zone and the smaller lower branch terminates near midventer. In ventral view there are three or four small longitudinal ridges and furrows along the bottom. Muscle scar consists of a vertical row of three pairs of scars with the upper pair obliquely arranged with respect to the middle and larger pair; the lower pair appears fused together in most specimens. There is a V-shaped antennal scar anterior

to these with another smaller scar below. Hingement is amphidont with anterior and posterior teeth of right valve being multilobate. The forms that are less tumid are believed to be the males.

Dimensions.—Plesiotype no. 5788, a male left valve from the Moodys Branch greensand member at locality 12: length 1.20 mm., height 0.61 mm.

Types.—Plesiotype no. 5787 is from the Moodys Branch greensand at locality 24; plesiotype nos. 5788-5790 are from the Moodys Branch greensand at locality 12.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 10; common at localities 11, 12 and 20; common to abundant at locality 22; common at locality 24. In the upper marl member: rare to common at locality 11; rare at localities 22 and 24. In the Cocoa sand member: rare at locality 26; rare to common at locality 31. In the Pachuta marl member: rare at localities 22 and 26.

Family BYTHOCYTHERIDAE Sars, 1926

Genus MONOCERATINA Roth, 1928

MONOCERATINA ALEXANDERI Howe and Chambers 1935

Pl. 5, figs. 1, 2

Monoceratina alexanderi Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 21, pl. 3, fig. 19; pl. 4, fig. 21; Monsour, 1937, AAPG Bull., vol. 21, no. 1, pp. 89, 94; Blake, 1950, Jour. Paleo., vol. 24, p. 183, pl. 29, fig. 27; Brown, 1958, N. C. Dept. Cons. and Dev., Div. of Min. Res. Bull. 72, p. 67, pl. 4, fig. 11; Pooser, 1965, Univ. Kans. Paleo. Contr. Art. 8, p. 37, pl. 8, figs. 5, 6.

Diagnosis.—Carapace is subrhomboidal in lateral view and strongly sculptured. Two ridges arch out anteriorly from the apex of the ala and form an oval-shaped enclosure in the anteromedian zone; two other ridges arch out from the apex of the ala and form an oval-shaped enclosure just posterior to the ala.

Brief description.—Carapace is subrhomboidal in lateral view. Dorsal and ventral margins are straight and parallel. Surface is sculptured with a strong ala and ridges. Four prominent

ridges radiate out from the apex of the ala. Two ridges arch out and form an oval-shaped enclosure in the anteromedian zone; two other ridges form a similar pattern on the posterior side of the ala. A high, thin subperipheral ridge extends parallel to the anterior and dorsal margins but turns down sharply near the posterodorsum. Still another ridge encloses a small subtriangular area in the midanterior zone. Hingement is lophodont.

Dimensions.—Plesiotype no. 5792, a left valve from the Moodys Branch greensand at locality 12: length 0.63 mm., height 0.30 mm.

Types.—Plesiotype no. 5791 is from the Moodys Branch greensand at locality 24; plesiotype nos. 5792 and 5793 are from the Moodys Branch greensand at locality 12.

Occurrence.—In the Moodys Branch formation greensand member: abundant at locality 11; rare at locality 12; rare to common at locality 24. In the Pachuta marl member: rare at localities 26 and 29.

MONOCERATINA MUCRONATA n. sp.

Pl. 5, figs. 3-6

Diagnosis.—Carapace is smooth, alate and subrhomboidal in lateral view. A prominent ala, tipped with a spine, projects from the centroventral zone of the valves. A small subcircular to elongate sulcus is present on the anterior edge of the ala near the alar apex.

Description.—Carapace is smooth, subrhomboidal in lateral view. It is subtriangular in dorsal view. Dorsal margin is straight; posterodorsal margin is slightly convex and partially obscured by a strong ala. There is commonly a small sharp spine at the tip of the ala. A small subcircular to elongate sulcus is present on the anterior edge of the ala near the alar apex. Anterior margin is broadly and evenly rounded; posterior margin is obliquely truncate. Greatest length is along a line through the mid-dorsomedian zone; greatest height is slightly postmedian.

On the inside, the valves are deep with broad marginal areas but have no vestibules. Musculature is undetermined. Hingement is modified lophodont. Groove of the right valve is faintly crenulate. Dimorphism is not determined.

Dimensions.—Holotype no. 5795, a left valve from the Pachuta marl member at locality 29: length 0.74 mm., height 0.44 mm.

Types.—Paratype nos. 5794, 5796 and 5797 are from the Pachuta marl member at locality 26.

Comparisons.—This species differs from *Monoceratina bifurcata* Puri from the Miocene of Florida in that the sulcus of *M. bifurcata* is median and more prominent than in *M.mucronata.* The latter also possesses a small alar spine which is not described for *M. bifurcata.*

Etymology.—Mucronata means "pointed". This name is suggested by the spine-tipped or sharply pointed alae.

Occurrence.—In the Yazoo formation lower beds (facies): very rare to rare at locality 1; rare at localities 7 and 11. In the Pachuta marl member: very rare to rare at locality 26; very rare at locality 29. In the Shubuta clay member: rare at locality 26.

MONOCERATINA sp.

Pl. 5, figs. 7, 8

Remarks.—Only a single carapace of this species was found in the Yazoo formation (lower beds) at locality 17. It is similar to *Monoceratina williamsi* Stephenson from the Weches (Claiborne) of Texas but the lobes of the alate structure are more nearly equal than in *M. williamsi.* It is figured for reference.

Dimensions.—Figured specimen no. 5798, a carapace from the Yazoo formation (lower beds) at locality 17: length 0.54 mm., height 0.31 mm.

Family CYTHERETTIDAE Triebel, 1952

Genus CYTHERETTA G. W. Müller, 1884

CYTHERETTA ALEXANDERI Howe and Chambers 1935

Pl. 5, figs. 9-12; Pl. 6, figs. 1, 2

Cytheretta alexanderi Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 45, 46, pl. 5, figs. 17-21; pl. 6, figs. 27, 28; Garrett, 1936, Jour. Paleo., vol. 10, p. 786 (list); Monsour, 1937, AAPG Bull., vol. 21, pp. 90, 95 (list); Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 109, pl. 11, fig. 20; Shimer and Shrock, 1944, *Index Fossils of North America*, p. 688, pl. 291, figs. 2-6; Blake, 1950, Jour. Paleo., vol. 24, no. 2, p. 177, pl. 30, figs. 1-3; Puri, 1952, Jour. Paleo., vol. 26, no. 2, pp. 208, 209, pl. 40, figs. 1, 2; Wilbert, 1953, Ark. Res. and Dev. Comm., Geol. Surv. Bull. 19, p. 125, pl. 1, fig. 15; Puri, 1957, Fla. Geol. Surv. Bull. 38, p. 195, pl. 7, figs. 1-4; Brown, 1958, N. C. Dept. Cons. and Dev., Div. of Min. Res. Bull. 72, p. 67, pl. 6, fig. 14; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 785, pl. 91, figs. 5, 6; Pooser, 1965, Univ. Kans. Paleo. Contr. Art. 8, p. 37, pl. 12, figs. 1, 2, 4-6.

Cythereis (?) catahoulana Howe and Pyeatt in Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 25, 26, pl. 3, fig. 7; pl. 6, figs. 25, 26; Monsour, 1937, AAPG Bull., vol. 21, pp. 89, 94 (list).

Cythereis (?) catahoulana var. pyeatti Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 26, 27, pl. 3, figs. 20, 21; Monsour, 1937, AAPG Bull., vol. 21, pp. 89, 95 (list).

Cytheretta sp. cf. C. alexanderi Howe and Chambers in Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 43; Swain, 1951, USGS Prof. Paper 234-A, p. 47, pl. 6, figs. 23-25.

Diagnosis. — Carapace is large, heavy, and ovate in lateral view. Posterior margin has an upward swing above the midpoint. Surface ornamentation consists of several rows of longitudinal ridges which converge posteriorly. Coarse pits align the furrows between the ridges.

Brief description. — Carapace is large, heavy, and ovate in lateral view. Posterior margin has an upward swing above the midpoint. Surface is ornamented with several rows of longitudinal, subparallel ridges which converge posteriorly. Between the ridges are furrows aligned with coarse pits.

On the inside, the marginal areas are broad with long, wavy, radial pore canals. Inner margin is S-shaped at the anterior. Muscle scar consists of a vertical row of four oval-shaped adductors with one antennal and one mandibular scar anterior to them. Hingement is holamphidont. Males are more elongate than females.

Dimensions. — Plesiotype no. 5802, a complete carapace from the Moodys Branch greensand at locality 12: length 1.00 mm., height 0.53 mm., thickness 0.49mm.

Types. — All types are from the Moodys Branch greensand at locality 12.

Occurrence. — Occurs commonly to abundantly at all sample localities and in all stratigraphic levels of the Jackson group in Mississippi except the Shubuta clay member.

Family CYTHERIDEIDAE Sars, 1925

Subfamily CYTHERIDEINAE Sars, 1925

Genus CLITHROCYTHERIDEA Stephenson, 1936

CLITHROCYTHEIDEA GARRETTI (Howe and Chambers) 1935

Pl. 6, figs. 3-6

Cytheridea (?) garretti Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 14, pl. 1, figs. 4, 5; pl. 2, figs. 11, 12; pl. 6, figs. 10, 11; Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 43.

Cytheridea (Clithrocytheridea) garretti (Howe and Chambers) in Stephenson, 1936, Jour. Paleo., vol. 10, p. 702, pl. 94, figs. 5, 6, 10; text figs. 11, o,p; Monsour, 1937, AAPG Bull. vol. 21, no. 1, pp. 89, 94 (list); Stephenson, 1942, Jour. Paleo., vol. 16, pp. 105, 110, pl. 18, fig. 1.

Cytheridea (Haplocytheridea) garretti Howe and Chambers in Shimer and Shrock, 1944, *Index Fossils of North America*, p. 689, pl. 290, figs. 15-17.

Clithrocytheridea garretti (Howe and Chambers) in Stephenson, 1944, Jour. Paleo., vol. 18, p. 449, pl. 76, fig. 1; Stephenson, 1946, Jour. Paleo., vol. 20, p. 327, pl. 42, fig. 18; Schweyer, 1949, All-Univ. Petrol. Res. Geol. Expl. Inst. VNIGRI, Trans. n.s. vol. 30, p. 98, pl. 1, fig. 4; Blake, 1950, Jour. Paleo., vol. 24, p. 175, pl. 29, figs. 9-11; Pokorny, 1958, *Grundzüge Der Zoologischen Mikropalaontologie*, Band II, p. 247, fig. 91; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 778, pl. 92, fig. 8; *Treatise on Invertebrate Paleontology (Q) Arthropoda*, 1961, pp. Q275, Q276, Fig. 204, figs. 1 a-d; Morkhoven, 1963, *Post-Paleozoic Ostracoda, Their Morphology, Taxonomy and Economic Use*, Elsevier, p. 282, fig. 440; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 13, fig. 5; Pooser, 1965, Univ. Kans. Paleo. Contr. Art. 8, p. 39, pl. 8, figs. 8-11.

Cleithrocytheridea garretti (Howe and Chambers) in Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125.

Cleithrocytheridea (Cytheridea) garretti (Howe and Chambers) in Grekoff, 1956, Inst. Francais du Petrol. p. 44, pl. 7, figs. 127-129.

Diagnosis. — Carapace is elongate, subtrapezoidal in lateral view. Surface of the valves is covered by large pits of various sizes which tend to align longitudinally near the ventral margin.

Brief description. — Carapace is elongate, subtrapezoidal in lateral view. Dorsal margin is slightly concave with a small angulation at the anterior cardinal angle. Posterodorsum slopes steeply. Ventral margin is straight, subparallel to the dorsal margin. Surface is covered by coarse pits of various sizes which tend to align longitudinally near the ventral margin. Muscle scar consists of a vertical row of four adductors with a V-shaped antennal scar anterior to the upper two adductors and another oval-shaped mandibular scar below it. Hingement is antimerodont. Males are more elongate than females.

Dimensions. — Plesiotype no. 5806, a male left valve from the Cocoa sand member at locality 31: length 0.86 mm., height 0.41 mm.

Types. — All types are from the Cocoa sand member at locality 31.

Remarks. — The valves of this species are heavier and slightly larger in the Moodys Branch greensand than those from overlying units.

Occurrence. — In the Moodys Branch formation greensand member: rare at locality 10; common at localities 11 and 12; abundant at localities 20 and 22; common to abundant at locality 24. In the upper marl member: rare to common at locality 11; abundant at locality 22; common to abundant at locality 24. In the North Twistwood Creek clay member: rare to common at locality 20; rare at locality 23; common at locality 25; rare at locality 30. In the Cocoa sand member: common to abundant at localities 26 and 31. In the Pachuta marl member: rare at locality 22; common to abundant at locality 26; rare to common at locality 29.

CLITHROCYTHERIDEA CALDWELLENSIS

(Howe and Chambers) 1935

Pl. 6, figs. 7, 8

Cytheridea (?) caldwellensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 11, pl. 1, fig. 7; pl. 2, figs. 4-6; Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 43.

Cytheridea caldwellensis Howe and Chambers in Garrett, 1936, Jour. Paleo., vol. 10, p. 786.

Cytheridea (Cleithrocytheridea) caldwellensis (Howe and Chambers) in Monsour, 1937, AAPG Bull., vol. 21, no. 1, pp. 89, 93; Stephenson, 1937, Jour. Paleo., vol. 11, no. 2, p. 154, pl. 26, fig. 13.

Cytheridea (Clithrocytheridea) caldwellensis (Howe and Chambers) in Brown, 1958, N. C. Dept. Cons. and Dev., Div. Min. Res. Bull. 72, p. 59, pl. 5, fig. 16.

Clithrocytheridea caldwellensis (Howe and Chambers) in Stephenson, 1946, Jour. Paleo., vol. 20, no. 4, p. 327, pl. 42, fig. 13; Blake, 1950, Jour. Paleo., vol. 24, no. 2, p, 175, pl. 29, fig. 12; Howe, 1951, Fla. Geol. Surv. Bull. 34, p. 6; Swain, 1951, USGS Prof. Paper 234-A, p. 24, pl. 2, fig. 28; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 777, pl. 92, fig. 3; Morkhoven, 1963, *Post-Paleozoic Ostracoda, Their Morphology, Taxonmy and Economic Use*, Elsevier, p. 284; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 13, fig. 6; Laurencich, 1969, Micropaleontology, vol. 15, no. 4, p. 496.

Cleithrocytheridea caldwellensis (Howe and Chambers) in Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125.

Diagnosis. — Carapace is trapezoidal in lateral view. Surface is sculptured by two low, rounded longitudinal ridges which extend posteriorly from a low flat swelling in the anteromedian zone. The upper ridge expands into an elevated flat area in the posteromedian zone and the lower ridge terminates in the posteroventral zone.

Brief description. — Carapace is subtrapezoidal in lateral view. Dorsal margin is slightly concave with a small peak at the anterior cardinal angle. Posterodorsum slopes steeply. Surface is sculptured by two low, rounded longitudinal ridges which extend posteriorly from a low flat swelling in the anteromedian zone. The upper ridge expands into an elevated flat area in the posteromedian zone and the lower ridge extends parallel to the venter and terminates in the posteroventral zone. Muscle scar is typical for the genus. Hingement is antimerodont. Males are more elongate than females.

Dimensions. — Plesiotype no. 5808, a male right valve from the Moodys Branch greensand at locality 12: length 0.71 mm., height 0.34 mm.

Types. — All types are from the Moodys Branch greensand at locality 12.

Occurrence. — In the Moodys Branch formation greensand member: common at localities 10 and 11; abundant at localities 12, 20, 22 and 24. In the upper marl member: rare to abundant at locality 11; abundant at localities 22 and 24. In the North Twistwood Creek clay member: common at locality 20; rare at locality 22; rare to abundant at locality 25; rare at locality 28; rare to common at locality 30. In the Cocoa sand member: rare at locality 26; rare to common at locality 31. In the Pachuta marl member: common at locality 26; very rare at locality 29.

CLITHROCYTHERIDEA GRIGSBYI

(Howe and Chambers) 1935

Pl. 6, figs. 9, 10; Pl. 7, fig. 1

Cytheridea (Haplocytheridea) chambersi Stephenson, 1937, Jour. Paleo., 5, pp. 15, 16, pl. 1, figs. 2, 3; pl. 2, figs. 8, 10, 17, 18; pl. 4, fig. 1; Garrett, 1936, Jour. Paleo., vol. 10, p. 786; Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 43.

Cytheridea (Cleithrocytheridea) grigsbyi (Howe and Chambers) in Monsour, 1937, AAPG Bull., vol. 21, no. 1, pp. 89, 93.

Cytheridea (Cleithrocytheridea (?)) grigsbyi (Howe and Chambers) in Bold, 1946, *Contribution to the Study of Ostracoda*, Utrecht Univ., J. H. DeBussy, Amsterdam, p. 80, pl. 7, fig. 15.

Clythrocytheridea (sic) grigsbyi (Howe and Chambers) in Schweyer, 1949, All-Union Petrol. Sci. Res. Geol. Expl. Inst. VNIGRI Trans. n.s. vol. 30, p. 98, pl 1, fig. 1.

Clithrocytheridea grigsbyi (Howe and Chambers) in Blake, 1950, Jour. Paleo., vol. 24, no. 2, p. 175, pl. 29, figs. 13-15; Bold, 1950, Jour. Paleo., vol. 24, no. 1, p. 108; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 778, pl. 92, fig. 12; Deboo, 1965, Geol. Surv. Ala. Bull. 80 pl. 13, fig. 4.

Cleithrocytheridea grigsbyi (Howe and Chambers) in Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125.

Diagnosis. — Carapace is elongate, subtriangular in lateral view. Surface is covered with numerous tiny pits. Normal pore canals

are visible and randomly scattered over the surface except near the venter where they tend to become aligned in longitudinal rows.

Brief description. — Carapace is elongate, subtriangular in side view. Dorsal margin is arched with a small peak at the cardinal angle. Surface of the valves is covered with numerous tiny pits. Normal pore canals are widely scattered over most of the valve surface with the thickest concentration near the ventral margin where they tend to align in parallel longitudinal rows. Muscle scar is typical for the genus. Hingement is antimerodont. Males are more elongate than females.

Dimensions. — Plesiotype no. 5811, a male right valve from the Cocoa sand member at locality 31: length 0.80 mm., height 0.43 mm.

Types. — All types are from the Cocoa sand member at locality 31.

Comparisons. — The valves of this species are larger in the Moodys Branch greensand than in the overlying stratigraphic horizons. Stephenson (1936) (1937) described three varieties of the above species which are very closely related to this species. He distinguished *Cytheridea (Clithrocytheridea) grigsbyi var. jacksonensis* by arrangement of the surface pits on the latter. *Cytheridea (Clithrocytheridea) grigsbyi var. chickasawhayana* he distinguished by the smaller and more closely spaced pits, and *Cytheridea (Clithrocytheridea) grigsbyi var. vicksburgensis* he distinguished by pointing out the less pronounced depression between the hinge and the dorsal margin than appears in *C. grigsbyi.*

Occurrence. — In the Moodys Branch formation greensand member: rare to common at locality 10; common to abundant at localities 11 and 12; abundant at localities 20 and 22; common to abundant at locality 24. In the upper marl member: common at locality 11; abundant at locality 22; rare to common at locality 24. In the Yazoo formation lower beds (facies): rare at localities 1, 6 and 16. In the North Twistwood Creek clay member: abundant at localities 20, 22 and 23; common to

abundant at localities 28 and 30; rare at locality 31. In the Cocoa sand member: abundant at localities 26 and 31. In the Pachuta marl member: common to abundant at locality 26; rare at locality 29. In the Shubuta clay member: very rare at locality 26.

CLITHROCYTHERIDEA SHUBUTENSIS

(Stephenson) 1937

Pl. 7, figs. 2-4

Cytheridea (Clithrocytheridea) shubutensis Stephenson, 1937, Jour. Paleo., vol. 11, no. 2, p. 156, pl. 26, fig. 1, text fig. 23.

Clithrocytheridea shubutensis (Stephenson) in Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 778, pl. 92, fig. 5.

Diagnosis. — Carapace is elongate, subreniform in lateral view. Surface of the valves is covered by large, deep, closely spaced round pits which tend to align in rows parallel to the margins.

Brief description. — Carapace is elongate, subreniform in lateral view. Dorsal margin is arched; ventral margin is concave. Posterior margin is subtruncate. Surface of the valve is covered by large, deep, closely spaced round pits which tend to align in rows parallel to the margins. Muscle scar consists of a vertical row of four oval-shaped adductors with two scars anterior to them. Hingement is antimerodont with a dorsal bar above the crenulated groove in the right valve. Males are more elongate than females.

Dimensions. — Plesiotype no. 5816, a male left valve from the Cocoa sand member at locality 31: length 0.69 mm., height 0.31 mm.

Types. — Plesiotype nos. 5814-5816 are from the Cocoa sand member at locality 31; plesiotype no. 5817 is from the Cocoa sand member at locality 26.

Occurrence. — In the Moodys Branch formation greensand member: rare at localities 10 and 12; common at localities 20 and 22; rare to common at locality 24. In the North Twistwood Creek clay member: very rare at locality 30. In the Cocoa sand member: rare at locality 26; common at locality 31.

Genus CYAMOCYTHERIDEA Oertli, 1956

CYAMOCYTHERIDEA CHAMBERSI

(Stephenson) 1937

Pl. 7, figs. 5-9

Cytheridea (Haplocytheridea) chambersi Stephenson, 1937, Jour. Paleo., vol. 11, no. 2, p. 147, pl. 26, fig. 2; text figs. 13, 22.

Diagnosis. — Carapace is smooth, ovate in lateral view. Each valve is moderately thick. Dorsum is arched with the highest point at the anterior cardinal angle. Anterior margin is broadly and evenly rounded; posterior margin is narrower than the anterior margin and evenly rounded.

Brief description. — Carapace is smooth, ovate in lateral view. Each valve is moderately thick. Dorsal margin is slightly convex with the highest point at the anterior cardinal angle; ventral margin is straight to slightly convex. Anterior margin is broadly and evenly rounded; posterior margin is narrower than anterior margin and more evenly rounded. Left valve is larger than right valve, more rounded, and overlaps the right valve along the dorsum and venter. Inner margins are moderately broad with a vestibule at the anterior. Muscle scar consists of a vertical row of four oval-shaped adductors with two scars anterior to them. Hingement is holomerodont. Males are more elongate and are not as plump posteriorly as the females.

Dimensions. — Plesiotype no. 5819, a male carapace from the North Twistwood Creek clay member at locality 25: length 0.63 mm., height 0.36 mm.

Types. — All types are from the North Twistwood Creek clay member at locality 25.

Comparisons. — This species, and the next two succeeding species, i.e. *C. hadleyi* and *C. watervalleyensis, infra,* are reassigned to the genus *Cyamocytheridea* because each species has an anterior vestibule and an evenly rounded posterior margin which are characteristic of the genus *Cyamocytheridea.*

Occurrence. — In the Moodys Branch formation greensand member: common at locality 10; rare to abundant at locality 12; common at locality 20; abundant at locality 22; rare to abundant at locality 24. In the upper marl member: rare to common at locality 11; abundant at localities 22 and 24. In the North Twistwood Creek clay member: abundant at locality 22; rare to abundant at localities 23 and 25; very rare at locality 28. In the Pachuta marl member: rare at locality 26.

CYAMOCYTHERIDEA HADLEYI (Stephenson) 1937

Pl. 7, figs. 10-13

Cytheridea (Haplocytheridea) hadleyi Stephenson, 1937, Jour. Paleo., vol. 11, no. 2, p. 150, pl. 26, fig. 16.

Cytheridea (Haplocytheridea) chambersi var. granulosa Stephenson, 1937, Jour. Paleo., vol. 11, no. 2, p. 148.

Diagnosis. — Carapace is slightly tumid, subovate in lateral view. Each valve is moderately thick. Right valve, when viewed alone, is subtriangular in lateral view. Surface of the valves is covered by coarse pits, randomly arranged.

Brief description. — Carapace is heavy, slightly tumid, subovate in lateral view. Each valve is moderately thick. Dorsal margin is slightly convex with the highest point at the anterior cardinal angle; ventral margin is straight. Anterior margin is broadly rounded; posterior margin is narrower than the anterior margin and more evenly rounded. Left valve is larger and more rounded than right valve and overlaps it along dorsum and venter. The right valve, when viewed alone, is subtriangular in lateral view. Surface of the valves is covered by numerous medium-sized to coarse pits randomly distributed.

On the inside, the marginal areas are moderately broad with a distinct vestibule at the anterior margin. Muscle scar consists of a vertical row of four adductors with two scars anterior to them. Hingement is holomerodont. Males are more elongate than females.

Dimensions. — Plesiotype no. 5822, a male left valve from the Moodys Branch greensand at locality 24: length 0.64 mm., height 0.33 mm.

Types. — All types are from the Moodys Branch greensand at locality 24.

Occurrence. — In the Moodys Branch formation greensand member: common at localities 10 and 11; common to abundant at locality 12; abundant at locality 22; common to abundant at locality 24. In the upper marl member: common at localities 11, 22 and 24. In the North Twistwood Creek clay member: very rare at locality 20.

CYAMOCYTHERIDEA WATERVALLEYENSIS

(Stephenson) 1937

Pl. 7, figs. 14, 15; Pl. 8, figs. 1-4

Cytheridea (Haplocytheridea) watervalleyensis Stephenson, 1937, Jour. Paleo., vol. 11, no. 2, p. 154, pl. 26, fig. 3; text figs. 1, 2, 9, 11, 12; Bold, 1946, *Contribution to the Study of Ostracoda*, Utrecht Univ. J. H. DeBussy, Amsterdam, p. 80.

Haplocytheridea watervalleyensis (Stephenson) in Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 124.

Cyamocytheridea watervalleyensis (Stephensons) in Kollman, 1960, Sonderdruck aus Mitterlungen der Geologischen Gesellschaft in Wien 51, Band, p. 157, pl. 10, figs. 1, 2, 13, 14; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, pp. 778, 779, pl. 91, fig. 2; pl. 93, fig. 16; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 12, fig. 13.

Diagnosis. — Carapace is tumid, subovate in lateral view. Each valve is moderately thick. Surface of the valves is smooth with numerous normal pore canals visible. Dorsal margin is gently convex; ventral margin is sinuous. Greatest height is at middorsum.

Brief description. — Carapace is heavy, tumid, subovate in lateral view. Dorsal margin is gently convex; ventral margin is sinuous to slightly convex. Greatest height is at middorsum. Anterior margin is broadly and obliquely rounded; posterior margin is narrower than anterior margin and more evenly rounded. Each valve is moderately thick. Surface is smooth with numerous normal pore canals visible.

On the inside, the marginal areas are moderately broad with a distinct vestibule at the anterior margin. Muscle scar

consists of a vertical row of four oval-shaped adductors with two scars anterior to the middle of the row. Hingement is holomerodont. Males are more elongate than females.

Dimensions. — Plesiotype no. 5826, a male left valve from the Moodys Branch greensand at locality 12: length 0.84 mm., height 0.47 mm.

Types. — Plesiotype nos. 5825, 5826 are from the Moodys Branch greensand at locality 12; plesiotype nos. 5823, 5824 are from the Cocoa sand member at locality 31.

Remarks. — The Moodys Branch greensand specimens of this species are heavier and tend to be larger than those found in the overlying Yazoo clays.

Occurrence. — In the Moodys Branch formation greensand member: common at locality 10; abundant at localities 11 and 12; common to abundant at locality 20; abundant at locality 22; common to abundant at locality 24. In the upper marl member: rare to common at locality 11; very rare at locality 22; very rare to rare at locality 24. In the North Twistwood Creek clay member: rare at localities 20 and 22; rare to common at locality 28; rare at locality 31. In the Cocoa sand member: common at locality 26; abundant at locality 31. In the Pachuta marl member: rare to common at locality 26.

Genus HAPLOCYTHERIDEA Stephenson, 1936

HAPLOCYTHERIDEA MONTGOMERYENSIS

(Howe and Chambers) 1935

Pl. 8, figs. 5-8

Cytheridea montgomeryensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 17, pl. 1, fig. 1; pl. 2, figs. 1-3, 7, 9; pl. 6, figs. 17, 18; Garrett, 1936, Jour. Paleo., vol. 10, p. 786; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 106, pl. 11, fig. 5; Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 43.

Cytheridea (Haplocytheridea) montgomeryensis (Howe and Chambers) in Stephenson, 1936, Jour Paleo., vol. 10, pp. 700, 701, pl. 94, figs. 3, 4, 9; text figs. 1 g, h, j, k; Monsour, 1937, AAPG Bull., vol. 21, no. 1, p. 89 (list);

Stephenson, 1937, Jour. Paleo., vol. 11, p. 153 (list); Stephenson, 1942, Jour. Paleo., vol. 16, pp. 109, 110, pl. 18, figs. 17, 18; Shimer and Shrock, 1944, *Index Fossils of North America*, p. 689, pl. 290, figs. 12-14.

Haplocytheridea montgomeryensis (Howe and Chambers) in Stephenson, 1946, Jour. Paleo., vol. 20, p. 322, pl. 42, fig. 16; Schweyer, 1949, All-Union Petrol. Sci. Res. Inst. VNIGRI Trans., n.s. vol. 30, p. 98, pl. 1, fig. 3; Blake, 1950, Jour. Paleo., vol. 24, no. 2, p. 176, pl. 29, fig. 16; Swain, 1951, USGS Prof. Paper 234-A, p. 20, pl. 1, fig. 18; pl. 2, figs. 1-4; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125, pl. 1, fig. 18; Grekoff, 1956, French Pet. Inst., Sed. Div., p. 46, pl. 7, figs. 131-138; Brown, 1958, N. C. Dept. Cons. and Dev., Div. Min. Res. Bull. 72, p. 57, pl. 5, fig. 4; Pokorny, 1958, *Grundzüge der Zoologischen Mikropalaontologie*, Band II, p. 245, fig. 908; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 779, pl. 91, fig. 7; *Treatise on Invertebrate Paleontology (Q) Arthropoda*, 1961, p. Q276, fig. 204, 2 a-c; Howe, R. C., 1963, La. Dept. Cons. Geol. Surv. Bull. 40, p. 23, pl. 2, figs. 6-9; Morkhoven, 1963, *Post-Paleozoic Ostracoda, Their Morphology, Taxonomy and Economic Use*, Elsevier, p. 279, figs. 434-436, 438; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 13, fig. 1; Pooser, 1965, Univ. Kans. Paleo. Contr. Art. 8, p. 41, pl. 5, fig. 10; pl. 6, figs. 1-4.

Diagnosis. — Carapace is tumid, subpyriform in lateral view. Anterior margin is broadly rounded with several spines in the ventral part. Posterior margin is subacute commonly having one or two short spines projecting from the extremity. The tumid anterior portion of the valves is ornamented with several curvilinear rows of pits which are subparallel to the anterior margin.

Brief description. — Carapace is tumid, subpyriform in lateral view. Anterior margin is broadly rounded with several spines in the ventral part. Posterior is subacute and commonly has one or two sharp spines projecting from the extremity. The tumid anterior portion of the valve is ornamented with several curvilinear rows of pits subparallel to the anterior margin.

On the inside, the marginal areas are moderately broad, depressed, with little, if any, vestibules. Muscle scar consists of a vertical row of four oval-shaped adductors with two scars anterior to them. Hingement is holomerodont. Females are smaller and less elongate than the males.

Dimensions. — Plesiotype no. 5827, female right valve from the Shubuta clay member at locality 26: length 0.67 mm., height 0.39 mm.

Types. — Plesiotype nos. 5827 and 5828 are from the Shubuta clay member at locality 26; plesiotype nos. 5829 and 5830 are

from the Cocoa sand member at locality 31; plesiotype no. 5831 is from the Moodys Branch greensand at locality 12.

Remarks. — The pit ornamentation on the valves of specimens of this species from the Shubuta clay member and the upper beds of the Yazoo formation is more pronounced than it is on the specimens from the lower units of the Jackson group, especially those from the North Twistwood Creek clay member.

Occurrence. — Common, abundant, or common to abundant in all stratigraphic levels and found at all sample localities of the Jackson group in Mississippi.

HAPLOCYTHERIDEA EHLERSI (Howe and Stephenson) 1935

Pl. 8, figs. 9, 10

Cytheridea ehlersi Howe and Stephenson in Howe and Chambers, 1935, La Dept. Cons. Geol. Bull. 5, p. 12, pl. 1, fig. 10; pl. 11, figs. 16, 19, 21.

Cytheridea kellumi Howe and Stephenson in Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 16, pl. 1, fig. 11; pl. 2, figs. 13-15; Monsour, 1937, AAPG Bull., vol. 21, no 1, p. 89.

Cytheridea (Haplocytheridea) ehlersi (Howe and Stephenson) in Stephenson, 1937, Jour. Palo., vol. 11, p. 150, pl. 26, fig. 6; Monsour, 1937, AAPG Bull., vol. 21, no. 1, p. 89.

Haplocytheridea ehlersi (Howe and Stephenson) in Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 13, fig. 3.

Diagnosis. — Carapace is subpyriform in lateral view. Posterior of the female valves is acute and usually has one spine projecting from the extremity. Surface of the valve is covered with numerous tiny, closely spaced pits.

Brief description. — Carapace is subpyriform is lateral view. Anterior margin is broadly and evenly rounded with six to eight small blunt spines in the ventral half; posteroventral margin is acute, commonly with one spine projecting from the extremity. Surface of the valves is covered with numerous tiny, closely spaced pits.

On the inside, the marginal areas are moderately broad, depressed, with very small vestibules. Hingement is holomerodont. Males are more elongate and larger than the females.

Dimensions. — Plesiotype no. 5832, a male right valve from the Shubuta clay member at locality 27: length 0.81 mm., height 0.41 mm.

Types. — All types are from the Shubuta clay member at locality 27.

Occurrence. — In the Yazoo formation lower beds (facies): rare at locality 3; common to abundant at locality 13. In the Yazoo formation upper beds (facies): common to abundant at localities 9 and 14; abundant at locality 15; common at locality 19. In the Shubuta clay member: abundant at locality 21; rare to common at localities 26 and 27; common at locality 29.

Genus PHRACTOCYTHERIDEA Sutton and Williams, 1939

PHRACTOCYTHERIDEA OUACHITENSIS (Stephenson) 1937

Pl. 9, figs. 1, 2

Haplocytheridea ouachitensis Stephenson, 1937, Jour. Paleo., vol. 11, no. 2, p. 153, pl. 26, fig. 4; text figs. 25, 26.

Haplocytheridea ehlersi (Howe and Stephenson) in part, in Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 12, 13, pl. 2, fig. 19; not pl. 1, fig. 10; pl. 2, figs. 16, 21.

Haplocytheridea n. sp. 1, Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 13, fig. 2.

Phractocytheridea ouachitensis (Stephenson) by Hazel, 1968, Jour. Paleo., vol. 42, no. 1, p. 131.

Diagnosis. — Carapace is tumid, subpyriform in lateral view. Anterior margin is broadly rounded, denticulate in the ventral half; posterior margin is subtruncate. Surface of the valves is smooth except for four to six transverse pitted furrows in the median zone.

Brief description. Carapace is tumid, subpyriform in lateral view. Anterior margin is broadly rounded, denticulate in ventral half; posterior margin is subtruncate. Ventral margin is concave approximately at midventer. Surface of the valves is smooth except for four to six transverse pitted furrows in the median zone.

On the inside, the marginal areas are moderately broad with very small vestibules. Muscle scar consists of a vertical row of four oval-shaped adductors with two oval-shaped scars, obliquely arranged, anterior to them. Hingement is holomerodont with a small platform-like process below the anterior tooth of the left valve. Males are larger, more elongate, and less acute posteriorly than the females.

Dimensions. — Plesiotype no. 5836, a female (?) right valve from the Yazoo formation (upper beds) at locality 18: length 0.78 mm., height 0.41 mm.

Types. — Plesiotype nos. 5834, 5835 and 5837 are from the Shubuta clay member at locality 26.

Remarks. — This species is referred to the genus *Phractocytheridea* because of the platform-like process below the anterior tooth of the left valve. Also, the concavity of the ventral margin is at midventer whereas in *Haplocytheridea* it is slightly post midventer.

Occurrence. — In the Yazoo formation lower beds (facies): common at locality 1; rare at locality 2; common to abundant at locality 13. In the Yazoo formation upper beds (facies): common at locality 8; common to abundant at locality 9; abundant at localities 14, 15 and 18; common at locality 19. In the Pachuta marl member: common at locality 22. In the Shubuta clay member: abundant at locality 21; common to abundant at locality 26.

PHRACTOCYTHERIDEA LIRATA n. sp.

Pl. 9, figs. 3-6

Diagnosis. — Carapace is tumid, subpyriform in lateral view. Anterior margin is broadly rounded and denticulate in the ventral half; posterior margin is subtruncate but narrower than the anterior margin. Surface of the valves is covered with deep, transverse pitted furrows which are vertical in the median zone, curvilinear and parallel to the margins in the anterior and posterior zones.

Description. — Carapace is tumid, subpyriform in lateral view. Dorsal margin is convex with a small peak at the anterior cardinal angle; ventral margin is straight to slightly concave at midventer. Anterior margin is broadly rounded with a small rim which is denticulate in the ventral half; posterior margin is subtruncate between broadly rounded posterodorsal and narrowly rounded posteroventral angles. Surface of the valves is covered with transverse pitted furrows which are vertical in the median zone, convex anteriorly in the anterior region and convex posteriorly in the posterior region.

On the inside, the valves are deep with moderately broad marginal areas. Vestibules are small. Radial pore canals are numerous, short, and occur in bundles of two or more irregularly spaced. The line of concrescence lies very near the inner margin along all margins except the anterior where it swings outward for a short distance toward the outer margin. Muscle scar pattern consists of a vertical row of four oval-shaped adductors. Two small round scars of the antennal group and one elongate mandibular scar are anterior to the adductor group. Another group of two or three small scars is present approximately midway between the adductors and the dorsum. Hingement is holomerodont with a small platform-like process beneath the anterior tooth of the left valve. The male is larger, more elongate, and less acute posteriorly than the female.

Dimensions. — Holotype no. 5840, a male left valve from the Yazoo formation (lower beds) at locality 2: length 0.80 mm., height 0.46 mm.

Types. — All types are from the Yazoo formation (lower beds) at locality 2.

Comparisons. — This species is similar to *H. veatchi* (Howe and Garrett) from the Sabine Eocene of Louisiana but differs in that the dorsal margin of *P. lirata* is less symmetrically arched and shows more angulation at the anterior cardinal angle than *H. veatchi.*

Etymology. — The name lirata means "furrows". This name is suggested by the transverse furrows on the valves of *P. lirata* n. sp.

Occurrence. — In the Yazoo formation lower beds (facies): abundant at locality 1; common at locality 2; common to abundant at locality 3; rare to abundant at locality 13. In the Yazoo formation upper beds (facies): common at locality 8; abundant at locality 14; rare at locality 18. In the Pachuta marl member: common at locality 22; rare at locality 29. In the Shubuta clay member: questionable occurrence, if it occurs at all, it is very rare at locality 26.

Subfamily EUCYTHERINAE Puri, 1954

Genus EUCYTHERE Brady, 1868

EUCYTHERE LOWEI Howe 1936

Pl. 9, figs. 7-10

Eucythere lowei Howe, 1936, Jour. Paleo., vol. 10, pp. 144, 145, figs. 4-6; Howe, R. C., 1963, La. Dept. Cons. Geol. Bull. 40, p. 24, pl. 3, fig. 1; Herrig, 1966, *Palaontologishe Deutschen Gesellschaft fur Geologische Wissenschaften*, Band II, p. 792, pl. 15, figs. 8 a-c.

Diagnosis. — Carapace is subtriangular in lateral view. Greatest height is at the anterior cardinal angle. Valve surface is smooth with large, round normal pore canals, randomly distributed.

Brief description. — Carapace is subtriangular in lateral view. Dorsal margin slants steeply to the posterior. Greatest height is at the anterior cardinal angle; greatest thickness is posterior to center. Surface is smooth with large, round normal pore canals visible. Muscle scar consists of four oval-shaped adductors in an oblique row with a large crescent-shaped scar anterior to them. Hingement is lophodont.

Dimensions. — Plesiotype no. 5843, a carapace from the North Twistwood Creek clay member at locality 23: length 0.43 mm., height 0.27 mm.

Types. — All types are from the North Twistwood Creek clay member at locality 23.

Remarks. — The left valve on cotype slide 1111, Henry V. Howe Collection, Louisiana State University, is designated as the lectotype of this species.

Occurrence. — In the Moodys Branch formation greensand member: very rare at locality 12. In the Yazoo formation lower beds (facies): very rare at localities 1 and 11. In the Yazoo formation upper beds (facies): rare at locality 14; very rare at locality 18. In the North Twistwood Creek clay member: very rare to rare at localities 22, 23, 25, 28, 30 and 31. In the Pachuta marl member: common at locality 26. In the Shubuta clay member: very rare at locality 27.

EUCYTHERE aff. E. WOODWARDENSIS Howe
Pl. 9, figs. 11, 12

Remarks. — This species occurs very rarely in the Pachuta marl member at localities 26 and 29; and in the Shubuta clay member at locality 26. It differs from *E. woodwardensis* Howe in being more acute at the posterior margin. It is figured for reference.

Dimensions. — Plesiotype no. 5845, a right valve from the Shubuta clay member at locality 26: length 0.61 mm., height 0.36 mm.

EUCYTHERE undetermined sp. A.
Pl. 9, fig. 13

Remarks. — Only one carapace of this species was found in the Pachuta marl member at locality 29. It is figured for reference.

Dimensions. — Figured specimen no. 5846, a carapace from the Pachuta marl member at locality 29: length 0.61 mm., height 0.39 mm.

EUCYTHERE undetermined sp. B.
Pl. 10, figs. 1, 2

Remarks. — This species is similar to *E. brownstownensis* Alexander, 1936, from the Midway (Eocene) of Texas but differs in being larger and the posterior is more produced than in *E. brownstownensis*. Only one carapace was found in the Pachuta marl member at locality 29. It is figured for reference.

Dimensions. — Figured specimen no. 5847, a carapace from the Pachuta marl member at locality 29: length 0.66 mm., height 0.37 mm.

EUCYTHERE undetermined sp. C.

Pl. 10, fig. 3

Remarks. — The delicate and distinctive ornamentation of the surface and the large size of the valves distinguish this species from others of the genus. Only one valve was found in the Moodys Branch greensand at locality 10. It is figured for reference.

Dimensions. — Figured specimen no. 5848, a left valve from the Moodys Branch greensand member at locality 10: length 0.76 mm., height 0.47 mm.

Subfamily KRITHINAE Mandelstam in Bubikan, 1958

Genus KRITHE Brady, Crosskey and Robertson, 1874

KRITHE HIWANNEENSIS Howe and Lea 1936

Pl. 10, figs. 4, 5

Krithe hiwanneensis Howe and Lea in Howe and Law, 1936, La. Dept. Cons. Geol. Bull. 7, p. 72, pl. 5, figs. 32-34; Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 54; Shimer and Shrock, 1944, *Index Fossils of North America*, p 691, pl. 291, figs. 33-35; Bold, 1946, *Contribution to the Study of Ostracoda*, Utrecht Univ., J. H. DeBussy, Amsterdam, p. 76, pl. 4, fig. 20; Bold, 1950, Jour. Paleo., vol. 24, no. 1, p. 108; Bold, 1958, Micropaleontology, vol. 4, no. 4, p. 395; Morkhoven, 1963, *Post-Paleozoic Ostracoda, Their Morphology, Taxonomy and Economic Use*, Elsevier, p. 344; Bold, 1964, Revista Geos. no. 11, p. 12; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 11, fig. 9; Bold, 1966, Jour. Paleo., vol. 40, no 1, p. 179; Bold, 1967, Micropaleontology, vol. 13, no. 1, p. 77; Laurencich, 1969, Micropaleontology, vol. 15, p. 497, pl. 1, fig. 14; pl. 2, figs. 8, 11.

Diagnosis.—Carapace is smooth, pellucid, elongate-ovate in lateral view. Dorsal and ventral margins are straight and parallel in the males; dorsal margin is convex in the females. Carapace is subcircular in end view with a V-shaped depression just above midposterior.

Brief description.—Carapace is smooth, pellucid, elongate-ovate in lateral view. Dorsal margin is convex in females, essentially straight in males. Carapace is subcircular in end view with a V-shaped depression just above the midposterior. Muscle scar consists of a vertical row of four oval-shaped adductors with one U-shaped scar and a small round scar below and anterior to the adductors. Hingement is adont.

Dimensions.—Plesiotype no. 5849, a female right valve from the Shubuta clay member at locality 27: length 0.67 mm., height 0.33 mm.

Types.—All types are from the Shubuta clay member at locality 27.

Occurrence.—In the Pachuta marl member: very rare to rare at localities 26 and 29. In the Shubuta clay member: rare to common at locality 26; common at locality 27; rare at locality 29.

Subfamily NEOCYTHERIDEIDINAE Puri, 1957

Genus CUSHMANIDEA Blake, 1933

CUSHMANIDEA ALTA (Blake) 1950
Pl. 10, figs. 6-8

Cytherideis alta Blake, 1950, Jour. Paleo., vol. 24, p. 180, pl. 29, figs. 22, 23.

Diagnosis.—Carapace is smooth, very elongate and subreniform in lateral view. Posterodorsum is obliquely truncate and posteroventer is narrowly rounded.

Brief description.—Carapace is elongate, smooth, subreniform in lateral view. Dorsal margin is gently convex; ventral margin is concave. Anterior margin is obliquely rounded and slightly extended in the anteroventral part. Posterior margin is obliquely truncate in the posterodorsal part and narrowly rounded in the posteroventral part. Muscle scar consists of a vertical row of four oval-shaped adductors with a V-shaped antennal scar, and another scar below, anterior to them. Hingement is lophodont. Males are more elongate and have a more acute posterior than females.

Dimensions.—Plesiotype no. 5943, a female left valve from the Moodys Branch greensand at locality 24: length 0.80 mm., height 0.37 mm.

Types.—Plesiotype nos. 5942, 5944 and 5945 are from the Moodys Branch greensand at locality 12.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 10; rare to common at locality 12; rare at locality 22; rare to common at locality 24. In the upper marl member: very rare at locality 24.

CUSHMANIDEA GOSPORTENSIS (Blake) 1950

Pl. 10, figs. 9, 10

Cytherideis gosportensis Blake, 1950, Jour. Paleo., vol. 24, p. 179, pl. 29, figs. 24, 25.

Diagnosis.—Carapace is smooth, elongate-ovate in lateral view. Anterior margin is obliquely rounded and denticulate. There are several faint undulations, subparallel to the anterior margin, present in the anterior zone.

Brief description.—Carapace is elongate-ovate in lateral view. Anterior margin is obliquely rounded, denticulate; posterior margin is broadly rounded in the females, oblique and extended in the posteroventral part of the males. Surface of the valves is smooth, with several visible, randomly distributed, normal pore canals. A series of faint undulations, subparallel to the anterior margin, is present in the anterior zone. Hingement is lophodont (?). Males are considerably more elongate than females.

Dimensions.—Plesiotype no. 5947, a male left valve from the Moodys Branch greensand at locality 12: length 0.86 mm., height 0.30 mm.

Types.—All types are from the Moodys Branch greensand at locality 12.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 10; rare to common at locality 12; rare at locality 20; common at locality 22; rare at locality 24.

CUSHMANIDEA KEYSERENSIS Krutak 1961

Pl. 10, figs. 11, 12

Cushmanidea keyserensis Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 779, pl. 92, fig. 6.

Diagnosis.—Carapace is smooth, elongate-ovate in lateral view. Normal pore canals are clustered and more numerous in the median and ventromedian zones. Along the bottom of the valves are several small, delicate subparallel ridges which converge posteriorly.

Brief description.—Carapace is elongate-ovate in lateral view. Surface of the valves is smooth with numerous, randomly distributed, normal pore canals which are more numerous in the median and ventromedian zones. Along the bottom of the valves are several small, delicate, subparallel ridges which converge posteriorly. Muscle scar is typical for the genus. Hingement is lophodont. Males are more elongate and much narrower in the posteroventral area than females.

Dimensions.—Plesiotype no. 5948, a male right valve from the Cocoa sand member at locality 31: length 0.84 mm., height 0.30 mm.

Types.—All types are from the Cocoa sand member at locality 31.

Occurrence.—In the North Twistwood Creek clay member: rare at locality 28. In the Cocoa sand member: common at locality 26; rare at locality 31. In the Pachuta marl member: rare at locality 26.

CUSHMANIDEA PAPULA Krutak 1961

Pl. 10, fig. 13; Pl. 11, figs. 1-3

Cushmanidea papula Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 780, pl. 92, fig. 9.

Diagnosis.—Surface of the valves is papillose. There are several rows of small granules in the anterior zone which are aligned subparallel to the anterior margin.

Brief description.—Carapace is elongate-ovate in the lateral view. Anterior margin is denticulate in the anteroventral part. Surface is papillose. There are several rows of small granules in the anterior zone aligned subparallel to the anterior margin. Muscle scar consists of a vertical to slightly arcuate row of four oval-shaped adductors with a heart-shaped antennal scar, and a smaller scar below, anterior to them. Hingement is lophodont. Males are more elongate and much narrower in the posteroventral part than the females.

Dimensions.—Plesiotype no. 5950, a female carapace from the Cocoa sand member at locality 31: length 0.81 mm., height 0.31 mm., thickness 0.31 mm.

Types.—All types are from the Cocoa sand member at locality 31.

Occurrence.—In the North Twistwood Creek clay member: very rare at locality 20; rare to common at locality 28; rare at localities 30 and 31. In the Cocoa sand member: common to abundant at localities 26 and 31. In the Pachuta marl member: very rare at locality 26.

CUSHMANIDEA SERANGODES Krutak 1961

Pl. 11, figs. 4, 5

Cushmanidea serangodes Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 780, pl. 92, fig. 10.

Diagnosis.—Carapace is elongate-subreniform in lateral view. Each valve is thick. Surface of the valves is covered with very coarse, widely-spaced pits. Anterior and posterior margins are obliquely rounded and subequal.

Brief description.—Carapace is elongate-subreniform in lateral view. Each valve is rather thick. Surface of the valves is covered with very coarse, widely spaced pits. Anterior and posterior margins are obliquely rounded and subequal. Muscle scar consists of a vertical row of four oval-shaped adductors with a heart-shaped antennal scar, and another scar below, anterior to them. Hingement in lophodont. Males are more elongate and less swollen at the posterior than females.

Dimensions.—Plesiotype no. 5954, a male right valve from the Cocoa sand member at locality 31: length 0.66 mm., height 0.24 mm.

Types.—All types are from the Cocoa sand member at locality 31.

Occurrence.—In the Cocoa sand member: common at localities 26 and 31.

CUSHMANIDEA sp.

Pl. 11, figs. 6, 7

Remarks.—Three valves of this species were found in the Cocoa sand member at locality 31. This species is illustrated for reference.

Dimensions.—Figured specimen no. 5957, a right valve is from the Cocoa sand member at locality 31: length 0.91 mm., height 0.40 mm.

Family CYTHERURIDAE G. W. Müller, 1894

Genus CYTHERURA Sars, 1866

CYTHERURA aff. C. ULTRA Blake 1950

Pl. 11, figs. 8-10

Diagnosis.—Carapace is small, alate, subquadrate in lateral view. A high thin ridge forms a gentle arch extending from the ventromedian edge of the ala to midanterior. A similar ridge arches over from the posteromedian edge of the ala to the caudal process. Other parts of the surface may be smooth or possess transverse connective ridges between the dorsum and the anterior alar region.

Brief description.—Carapace is small, alate, subquadrate in lateral view. Surface is ornamented by a high thin ridge which forms a gentle arch extending from the ventromedian edge of the ala to the midanterior. A similar ridge, but more convex dorsally than the first, arches over from the posteromedian edge of the ala to the caudal process. In some specimens, there may be other transverse connective ridges between the dorsum and the anterior alar ridge which are convex toward the anterior. One of these may bifurcate forming a small subtriangular enclosure above the anterior alar ridge. Hingement is modified lophodont and consists of a groove below the dorsal margin of the right valve which extends between small faintly notched anterior and posterior tooth elements. Dimorphism is not determined.

Dimensions.—Plesiotype no. 5960, a left valve from the Moodys Branch greensand at locality 12: length 0.48 mm., height 0.26 mm.

Types.—Plesiotype nos. 5959 and 5960 are from the Moodys Branch greensand at locality 12; plesiotype no. 5961 is from the Moodys Branch greensand at locality 24.

Comparisons.—The figured specimens deviate slightly from the types in the configuration of the ridges on the valve surface and in having a less prominent sulcus.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 12; very rare at localities 22 and 24.

CYTHERURA JACKSONI n. sp.

Pl. 11, figs. 14-16

Diagnosis.—Carapace is small, alate, subquadrate in lateral view. Valve surface is covered with a honeycomb-like network of large reticles. There is a high thin ridge which extends in a gentle arch from the anterior side of the ala to the anterior margin and another ridge extends in a more convex arch from a point just slightly postmedian on the alar edge to the posterior caudal process.

Description.—Carapace is small, alate, subquadrate in lateral view. Anterior margin is evenly rounded with a thin fragile rim. Midposterior margin is drawn out into a sharp caudal process. Dorsal and ventral margins are essentially straight and parallel. Surface is covered with honeycomb-like network of large reticles. A high thin ridge extends in a gentle arch from the anterior side of the alar edge to the anterior margin. A similar ridge arches up strongly from a point slightly postmedian on the alar edge to the posterior caudal process. There is a shallow vertical sulcus slightly anterior to median.

On the inside, the valves are moderately deep with broad, depressed marginal areas. Radial pore canals are few and widely spaced. The line of concrescence appears to coincide with the inner margin. Hingement is modified lophodont and consists of a groove below the dorsal margin of the right valve which extends between small faintly notched anterior and posterior tooth elements. Dimorphism is not determined.

Dimensions.—Holotype no. 5966, a left valve from the Moodys Branch greensand at locality 24: length 0.43 mm., height 0.23 mm.

Types.—Paratype nos. 5965 and 5967 are from the Moodys Branch greensand at locality 12; paratype no. 5968 is from the Moodys Branch greensand at locality 24.

Comparisons.—This species differs from *C. semireticulata* Blake and also from *C. moorei* n. sp. in having coarser reticles and also in possessing small convex ridges that extend from the alar edge to the anterior and posterior zones.

Etymology.—This species is named in honor of Mr. Alan Jackson, Independent Geologist, Hattiesburg, Mississippi.

Occurrence.—In the Moodys Branch formation greensand member: very rare at locality 22; rare at locality 24.

CYTHERURA MOOREI n. sp.

Pl. 11, figs. 11-13

Diagnosis.—Carapace is small, alate, subovate in lateral view. Valves are without sculpture except for the alar process. Surface is pitted to reticulate.

Description.—Carapace is small, alate, subovate in lateral view. Dorsal margin is straight to gently convex on right valve; essentially straight on left valve. Ventral margin is straight. Anterior margin is evenly rounded; midposterior margin is produced into a sharp caudal process. Except for the alar process the valves are without strong sculpture. Surface is pitted to slightly reticulate.

On the inside, the valves are moderately deep with broad, depressed marginal areas. Radial pore canals are few and widely spaced. The line of concrescence coincides with the inner margin at the anterior and posterior margins. Muscle scar is uncertain but appears to consist of a vertical row of four oval-shaped adductors with two or three small scars anterior to them. Hingement is modified lophodont and consists of a groove below the dorsal margin of the right valve which extends between small faintly notched anterior and posterior tooth elements.

Dimensions.—Holotype no. 5964, a left valve from the Moodys Branch greensand at locality 24: length 0.49 mm., height 0.26 mm.

Types.—All types are from the Moodys Branch greensand at locality 24.

Comparisons.—The species of nearest affinity to *C. moorei* n. sp. is *Cytherura semireticulata* Blake. They differ, however, in that the surface of *C. moorei* n. sp. is more pitted and the carapace outline is more rectangular than in *C. semireticulata.*

Etymology.—This species is named in honor of Mr. William H. Moore, Director of the Mississippi Geological, Economic and Topographical Survey in Jackson, Mississippi.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 12; very rare at locality 22; rare to common at locality 24. In the North Twistwood Creek clay member: very rare at localities 20 and 28. In the Pachuta marl member: very rare at locality 22.

Genus CYTHEROPTERON Sars, 1866

CYTHEROPTERON DANVILLENSIS

Howe and Chambers 1935

Pl. 11, figs. 17, 18

Cytheropteron danvillensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 20, pl. 3, fig. 17; pl. 4, figs. 13, 14; Monsour, 1937, AAPG Bull., vol. 21, pp. 89, 94; Bold, 1950, Jour. Paleo., vol. 24, no. 1, p. 108; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 12, fig. 5.

Diagnosis.—Carapace is smooth to slightly reticulate, alate, ovate in lateral view. A strong ala projects from the midventral inflated zone and there is a small subtriangular spine slightly posterior to the alar apex.

Brief description.—Carapace is alate, smooth to slightly reticulate, ovate in lateral view. Dorsal and ventral margins are convex. Anterior margin is evenly rounded and merges smoothly with the dorsum and venter. Posterior margin is produced into a short caudal process. A strong ala projects from the midventral inflated zone of the carapace and there is a small subtriangular spine on the ala just posterior to the apex. Muscle scar consists of a vertical row of four oval-shaped adductors with a V-shaped scar, and another scar below, anterior to them. Hingement is modified antimerodont. In the right valve there are elongate, crenulated dental cusps at each cardinal angle connected by a

crenulated groove. The hinge of the left valve contains corresponding crenulated sockets and a connecting bar. Dimorphism is not determined.

Dimensions. — Plesiotype no. 5969, a right valve from the Yazoo formation upper beds at locality 19: length 0.45 mm., height 0.28 mm.

Types. — All types are from the Yazoo formation upper beds at locality 19.

Comparisons. — This species differs from *Cytheropteron montgomeryensis* Howe and Chambers in being narrower and having less prominent alae.

Remarks. — The specimen on cotype slide 1131, Henry V. Howe Collection, Louisiana State University, is designated as the lectotype of this species.

Occurrence. — In the Moodys Branch formation greensand member: rare at locality 12; very rare to rare at localities 22 and 24. In the Yazoo formation lower beds (facies): very rare at localities 1 and 11. In the Yazoo formation upper beds (facies): rare to common at locality 9; very rare to rare at locality 14; very rare at locality 18; common at locality 19. In the Cocoa sand member: very rare at localities 26 and 31. In the Pachuta marl member: very rare at locality 26. In the Shubuta clay member: very rare at localities 21 and 27.

CYTHEROPTERON MONTGOMERYENSIS

Howe and Chambers 1935

Pl. 11, figs. 19-21

Cytheropteron montgomeryensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 19, pl. 3, figs. 14-16; pl. 4, figs. 11, 12, 16; Garrett, 1936, Jour. Paleo., vol. 10, p. 786; Monsour, 1937, AAPG Bull., vol. 21, no. 1, p. 89; Fisk, 1939, AAPG Bull., vol. 23, no. 9, p. 1399; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 106, pl. 11, fig. 6; Shimer and Shrock, 1944, *Index Fossils of North America*, p. 693, pl. 292, figs. 16-21; Bold, 1946, *Contribution to the Study of Ostracoda*, Utrecht University, J. H. DeBussy, Amsterdam, p. 114, pl. 2, fig. 2; Bold, 1950, Jour. Paleo., vol. 24, no. 1, p. 108; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125; Bold, 1960, Micropaleontology, vol. 6, no. 2, p. 177; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 777, pl. 93, fig. 12.

Diagnosis. — Carapace is smooth but occasionally pitted in the posterior half, ovate in lateral view. A strong ala, tipped with a spine, projects from the midventral inflated zone of the carapace. Another small subtriangular spine is present on the ala just posterior to the alar apex.

Brief description. — Carapace is generally smooth but may show several vertical rows of pits in the posterior half; ovate in lateral view. Dorsal and ventral margins are convex. Anterior margin is evenly rounded; posterior margin is produced into a short caudal process. A strong ala projects from the midventral inflated zone of the carapace and terminates with a spine at its apex. There is another small subtriangular spine on the ala just posterior to the alar apex. Muscle scar consists of a vertical row of four oval-shaped adductors with two scars anterior to them. Hingement is modified antimerodont. In the right valve there are elongate crenulated cusps at the cardinal angles connected by a depressed crenulated groove. The left valve hinge consists of elongate crenulated sockets connected by an elevated crenulated bar. Males are slightly more elongate than females.

Dimensions. — Plesiotype no. 5973, a left valve from the North Twistwood Creek clay member at locality 23: length 0.51 mm., height 0.29 mm.

Types.—Plesiotype nos. 5972 and 5974 are from the Yazoo formation lower beds at locality 4.

Remarks. — The specimen on cotype slide no. 836, Henry V. Howe Collection, Louisiana State University, is designated as the lectotype of this species.

Occurrence. — Common, common to abundant or rare to abundant in all stratigraphic levels and found at nearly all localities of the Jackson group in Mississippi.

CYTHEROPTERON LANCEOLATA n. sp.

Pl. 11, fig. 22; Pl. 12, figs. 1-3

Diagnosis.—Carapace is ovate in lateral view;sagittate in dorsal view. Surface of the valves reticulate in median zone. A keel-like ala projects obliquely from the midventral zone of the carapace.

Description. — Carapace is small, ovate in lateral view; sagittate in dorsal view. Dorsal and ventral margins are convex; ventral margin is obscured by a strong ala. Anterior margin is narrowly and evenly rounded; posterior margin is produced into a short caudal process. A strong keel-like ala protrudes somewhat obliquely from midventer. Surface of the valves is reticulate in the median zone.

On the inside, the valves are moderately deep with broad marginal areas. Radial pore canals are few and widely spaced. The line of concrescence lies between the inner and the outer margins. Muscle scar consists of four small oval-shaped adductors in a vertical row with two small scars in front. Hingement of the right valve consists of a crenulated cusp at each cardinal angle connected by a depressed row of crenulations. Hinge of the left valve consists of corresponding crenulated sockets connected by a crenulated bar. Dimorphism is not certain. In some of the specimens the dorsal margin is not as strongly arched as in some others which makes them appear slightly more elongate. These may be the males.

Dimensions. — Holotype no. 5976, a carapace from the North Twistwood Creek clay member at locality 30: length 0.50 mm., height 0.26 mm., thickness 0.29 mm.

Types. — All types are from the North Twistwood Creek clay member at locality 30.

Comparisons. — This species differs from *C. montgomeryensis* Howe and Chambers by the absence of spines on the ala; also, in dorsal view, the carapace is not as wide and the alae are not as prominent as in *C. montgomeryensis*. It differs from *C. variosum* Martin in that the dorsum is not as arched; also, the alae do not extend laterally over as much surface as in *C. variosum*.

Etymology. — Lanceolata means "spear-shaped". This describes the spear-shaped appearance of the carapace of this species in dorsal view.

Occurrence. — In the Moodys Branch formation upper marl member: rare at locality 24. In the Yazoo formation lower beds (facies) : very rare at localities 4, 5 and 6. In the North Twistwood Creek clay member: rare at locality 25; common to abun-

dant at localities 28 and 30; rare to common at locality 31. In the Cocoa sand member: very rare at localities 26 and 31. In the Pachuta marl member: rare to common at locality 26.

Genus KONAROCYTHERE (Méhes) 1941, Nom. Nov. Krutak, 1961

= Budaia Méhes, 1941, (not Budaia Wells, 1933)

KONAROCYTHERE SPURGEONAE

(Howe and Chambers) 1935

Pl. 12, figs. 4-6

Eocytheropteron spurgeonae Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 20, 21, pl. 3, fig. 18; pl. 4, fig. 2; pl. 6, figs. 12, 13; Garrett, 1936, Jour. Paleo., vol. 10, no. 1, p. 89; Monsour, 1937, AAPG Bull., vol. 21, pp. 89, 93 (list); Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 44; Pooser, 1965, Univ. Kans. Paleo. Contr. Art. 8, p. 48, pl. 10, figs. 9-11.

Konarocythere spurgeonae (Howe and Chambers) in Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 776, pl. 92, fig. 4; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 12, fig. 11.

Diagnosis.—Carapace is tumid, ovate in lateral view with the valves strongly inflated in the midventral zone. Numerous normal pore canals are aligned longitudinally in parallel rows along the steep ventral slope of the inflated portion of the valves. Ventral margin is obscured in lateral view by the overhang of the tumid portion of the valves.

Brief description. — Carapace is tumid, ovate in the lateral view with valves strongly inflated in the midventral zone. Dorsal margin is smoothly arched; ventral margin is slightly convex and partially obscured by overhang of the tumid portion of the valves. Posterior margin is slightly produced into a short, blunt caudal process. Numerous normal pore canals are aligned longitudinally in parallel rows along the steep ventral slope of the tumid portions of the valve. Muscle scar consists of a vertical row of four oval-shaped adductors with two scars anterior to them. Hinge of the right valve consists of a slightly elevated single row of crenulations at each cardinal angle connected by a depressed crenulated groove. Hinge of the left valve consists of a depressed double row of crenulations at each card-

inal angle connected by a slightly elevated crenulated bar. Males are more elongate than females and the dorsal margin in the males is not as strongly convex as in the females.

Dimensions. — Plesiotype no. 5980, a female left valve from the Moodys Branch greensand at locality 12: length 0.73 mm., height 0.49 mm.

Types. — All types are from the Moodys Branch greensand at locality 12.

Occurrence. — In the Moodys Branch formation greensand member: rare at localities 10 and 11; common at localities 12, 20, 22 and 24. In the upper marl member: rare at locality 11; abundant at locality 22; rare to common at locality 24. In the Yazoo formation lower beds (facies): rare at localities 1, 6 and 7. In the North Twistwood Creek clay member: common at localities 20 and 22; abundant at locality 23; common to abundant at locality 25; abundant at locality 28; common to abundant at locality 30; common at locality 31. In the Cocoa sand member: common at locality 26; common to abundant at locality 31. In the Pachuta marl member: common at locality 26.

Genus PARACYTHERIDEA G. W. Müller, 1894

PARACYTHERIDEA BELHAVENENSIS

Howe and Chambers 1935

Pl. 12, figs. 7-9

Paracytheridea belhavenensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 18, pl. 5, fig. 9; Garrett, 1936, Jour. Paleo., vol. 10, p. 786; Monsour, 1937, AAPG Bull., vol. 21, no. 1, pp. 89, 93; Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 43; Blake, 1950, Jour. Paleo., vol. 24, p. 176, pl. 29, figs. 3, 4; Brown, 1958, N. C. Dept. Cons. and Dev. Comm., Div. Min. Res. Bull. 72, p. 59, pl. 8, fig. 7; Deboo, 1965, Geol Surv. Ala. Bull. 80, pl. 12, fig. 3; Laurencich, 1969, Micropaleontolgy, vol. 15, p. 496, pl. 1, fig. 11, 12.

Paracytheridea palmerae Stephenson, 1946, Jour. Paleo., vol. 20, p. 317, pl. 42, fig. 14; pl. 44, fig. 19.

Paracytheridea bastropensis Stephenson, 1947, Jour. Paleo., vol. 21, p. 579.

Diagnosis. — Carapace is strongly alate, subquadrate in lateral view. Valve surface is sculptured by a strong swept-back ala.

Four small ridges radiate out from a subcircular depression in the anteromedian zone with one short ridge extending down to the alar edge. Another ridge extends to the anterodorsum; another ridge extends to the midanterior margin; and still another ridge extends posteriorly and terminates in the ventromedian zone.

Brief description. — Carapace is strongly alate, subquadrate in lateral view. The posterodorsal margin is drawn out into a long pointed caudal process. Valve surface is sculptured by a strong swept-back ala which projects from the mid-ventral zone. There is a ridge-enclosed subcircular depression in the anteromedian zone from which four small ridges radiate. One short ridge extends down to the alar edge; a second ridge extends longitudinally to the midanterior margin; a third ridge extends almost to the anterodorsal margin; and a fourth short ridge extends posteriorly but terminates in the ventromedian zone. A wide, vertical median sulcus extends from the anterior alar edge to the dorsum. The muscle scar consists of a vertical row of four irregularly shaped adductors with two scars anterior to them. Hinge is weakly antimerodont. Males are more elongate than females.

Dimensions. — Plesiotype no. 5982, a female left valve from the Moodys Branch greensand at locality 12: length 0.70 mm., height 0.34 mm.

Types. — Plesiotype nos. 5982, 5983 are from the Moodys Branch greensand at locality 12; plesiotype nos. 5981, 5984 are from the Moodys Branch greensand at locality 24.

Remarks. — The left valve on cotype slide 1133, Henry V. Howe Collection, Louisiana State University, is designated as the lectotype of this species.

Occurrence. — In the Moodys Branch formation greensand member: rare to common at locality 10; rare to abundant at locality 12; common at locality 20; abundant at locality 22; rare to common at locality 24. In the upper marl member: common at locality 11; rare at locality 24. In the North Twistwood Creek clay member: very rare at localities 20 and 25; common at locality 28; rare to common at locality 30; rare at locality 31. In the Cocoa sand member: rare at localities 26 and 31. In the Pachuta marl member: rare at locality 26.

Family HEMICYTHERIDAE Puri, 1953

Genus HEMICYTHERE Sars, 1925

HEMICYTHERE BELLULA Howe 1951

Pl. 12, figs. 10-12

Hemicythere bellula Howe, 1951, Fla. Geol. Surv. Bull. 34, pp. 14, 15, pl. 3, figs. 12-14; Puri, 1953. Wash. Acad. Sci. Jour., vol. 43, p. 169.

Diagnosis.—Carapace is subrectangular to almond-shaped in lateral view. Posterodorsum is concave. Surface of the valves is coarsely reticulate with the reticles radiating out from the center and becoming coarser near the anterior and posterior marginal zones.

Brief description.—Carapace is subrectangular to almond-shaped in lateral view. Dorsal margin is slightly convex; ventral margin is straight to slightly concave. Posterodorsum is strongly concave. Surface of the valves is coarsely reticulate with the reticles tending to radiate out from the center and becoming coarser near the anterior and posterior marginal zones. Muscle scar consists of a slightly arcuate row of four adductors on the posterior edge of the muscle scar depression with two scars anterior to them within the depression. Hingement is holamphidont.

Dimensions.—Plesiotype no. 5986, a complete carapace from the Moodys Branch greensand at locality 24: length 0.60 mm., height 0.39 mm.

Types.—All types are from the Moodys Branch greensand at locality 24.

Occurrence.—In the Moodys Branch formation greensand member: common at localities 22 and 24.

HEMICYTHERE (?) CRONEISI n. sp.

Pl. 12, figs. 13-15; Pl. 13, figs. 1, 2

Diagnosis.—Carapace is subrectangular to subovate in lateral view. Surface of the valves is coarsely reticulate and sculptured with several small, rounded, subparallel longitudinal ridges across

the median zone of the valves. There are also several subparallel ridges which tend to slant toward the anteroventral zone in the anterior third of the valves.

Description.—Carapace is subrectangular to subovate in lateral view. Dorsal margin is slightly convex; ventral margin is slightly concave. Anterior margin is broadly and obliquely rounded with a narrow raised rim. Posterior margin is acuminate at the middle; concave in the posterodorsal part. Greatest height is at the anterior cardinal angle; greatest thickness is at the middle. Surface of the valves is coarsely reticulate and sculptured with several small, rounded, subparallel longitudinal ridges across the median zone of the valves. There are several small subparallel ridges which tend to slant toward the anteroventral margin in the anterior third of the valve. There is also a weakly developed subcentral tubercle.

On the inside, the valves are moderately deep with broad marginal areas. Radial pore canals are numerous and closely spaced. The line of concrescence coincides with the inner margin throughout. Muscle scar consists mainly of a vertical row of four adductor elements. The top element generally consists of a single scar; the two middle elements are each paired and there is a single small round scar at the bottom. In front of the adductors there are two small round scars obliquely aligned. Hingement is holamphidont. Dimorphism is not certain but some of the specimens are slightly more elongate than others and may be the males.

Dimensions.—Holotype no. 5989, a female (?) carapace from the Moodys Branch greensand at locality 22: length 0.69 mm., height 0.40 mm.

Types.—Paratype no. 5988 is from the Moodys Branch formation greensand member at locality 22; paratype no. 5992 is from the Moodys Branch formation upper marl member at locality 24; paratype nos. 5990, 5991 are from the North Twistwood Creek clay member at locality 23.

Comparisons.—This species differs from *H. bellula* Howe in the nature of the surface sculpturing and ornamentation and in being more elongate in outline.

Remarks.—This species is questionably assigned to the genus *Hemicythere* because of the weakly developed subcentral tuber-

cle. On the other hand, the overall shape of the carapace, the hingement and the musculature are similar to that of *Hemicythere.*

Etymology.—This species is named in honor of Dr. Carey Croneis, Chancellor, The Rice University, Houston, Texas.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 12; common at locality 20; rare at locality 22. In the upper marl member: very rare at locality 24. In the North Twistwood Creek clay member: rare at locality 23.

Family LEGUMINOCYTHEREIDIDAE Howe, 1961

Genus ACUTICYTHEREIS Edwards, 1944

ACUTICYTHEREIS COCOAENSIS Krutak 1961

Pl. 14, figs. 2-5

Acuticythereis cocoaensis Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 781, pl. 92, fig. 2.

Diagnosis.—Surface of the valves is smooth except for several widely-spaced orifices of normal pore canals in the median zone and a few short raised ribs in the posteroventral zone. There is an incised line that occurs just inside the free border around most of the valve.

Brief description.—Carapace is elongate-ovate in lateral view. Surface of the valves is smooth except for several widely-spaced orifices of normal pore canals in the median zone and a few short raised ribs in the posteroventral zone. There is an incised line that occurs just inside the free border around most of the valve. Muscle scar consists of four oval-shaped adductors in a vertical row with two small round scars anterior to them. There are also two small round scars just above the main group and another scar is located approximately midway between the adductors and the ventral margin. Hingement is holamphidont. Males are more elongate than females.

Dimensions.—Plesiotype no. 6006, a female right valve from the Cocoa sand member at locality 31: length 0.71 mm., height 0.33 mm.

Types.—All types are from the Cocoa sand member at locality 31.

Occurrence.—In the Cocoa sand member: rare at locality 26; rare to common at locality 31.

Genus BASSLERITES Howe in Coryell and Fields, 1937

BASSLERITES sp.

Pl. 14, fig. 6

Remarks.—A single valve of this species was found in the Moodys Branch greensand at each of the following localities: 12, 22 and 24; and a single valve was found in the Cocoa sand member at locality 31. It is figured for reference.

Dimensions.—Figured specimen no. 6010, a right valve from the Moodys Branch greensand at locality 12: length 0.74 mm., height 0.37 mm.

Genus TRIGINGLYMUS Blake, 1950

TRIGINGLYMUS HYPEROCHUS Blake 1950

Pl. 13, figs. 3-5

Triginglymus hyperochus Blake, 1950, Jour. Paleo., vol. 24, p. 181, pl. 30, figs. 4-9; Grekoff, 1956, French Pet. Inst., Sed. Div., p. 71, pl. 16, figs. 399, 401; *Treatise on Invertebrate Paleontology (Q) Arthropoda*, 1961, p. Q307, fig. 233, 4 a-c.

Leguminocythereis hyperochus (Blake) in Pokorny, 1958, *Grundzüge Der Zoologischen Mikropalaontologie*, Band II, p. 272, fig. 955.

Diagnosis.—Carapace is elongate-ovate in lateral view. Surface is coarsely reticulate with the reticles arranged more or less in rows subparallel to the margins.

Brief description.—Carapace is elongate-ovate in lateral view. Surface is coarsely reticulate with reticles arranged more or less in rows subparallel to the margins. Muscle scar is typical for the genus. Hingement is holamphidont with a subtriangular projection just behind the anterior tooth element of each valve.

Dimensions.—Plesiotype no. 5994, a male right valve from the Moodys Branch greensand at locality 12: length 0.74 mm., height 0.34 mm.

Types.—Plesiotype nos. 5993, 5994 and 5996 are from the Moodys Branch greensand at locality 12; plesiotype no. 5995 is from the Moodys Branch greensand at locality 24.

Occurrence.—In the Moodys Branch formation greensand member: rare at localities 12 and 24. In the Cocoa sand member: very rare at locality 31.

TRIGINGLYMUS GNYTHOPHOREUS Krutak 1961

Pl. 13, figs. 6-11

Triginglymus gnythophoreus Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 784, pl. 93, figs. 4, 8, 11.

Diagnosis.—Carapace is elongate-ovate in lateral view. Surface of the valves is pitted. The pits are randomly arranged in the central zone but subparallel to the margins in the posterior and ventral zones.

Brief description.—Carapace is elongate-ovate in lateral view. Anterior margin is obliquely rounded, with a low rounded rim, and strongly extended in the anteroventral part; posterior margin is subtruncate. Surface of the valves is pitted. The pits are randomly arranged in the central zone but subparallel to the margins in the posterior and ventral zones. Muscle scar is typical for the genus. Hingement is holamphidont modified with a subtriangular tooth-like projection just behind the anterior tooth element of each valve.

Dimensions.—Plesiotype no. 5997, a female carapace from the Cocoa sand member at locality 31: length 0.63 mm., height 0.29 mm.

Types.—All types are from the Cocoa sand member at locality 31.

Occurrence.—In the North Twistwood Creek clay member: rare at localities 25 and 28. In the Cocoa sand member: common at localities 26 and 31.

TRIGINGLYMUS LONGICOSTATA (Blake) 1950

Pl. 13, figs. 12-16

Cythereis (?) longicostata Blake, 1950, Jour. Paleo., vol. 24, p. 178, pl. 29, figs. 20, 21.

Diagnosis.—Carapace is very elongate. Surface of the valves is ornamented with several delicate longitudinal ribs. Between the ribs are furrows and in each furrow there are two rows of small, closely spaced normal pore openings.

Brief description.—Carapace is very elongate in lateral view. Dorsal margin is straight to slightly sinuate; ventral margin is slightly concave at midventer. Both margins tend to converge posteriorly. Anterior margin is broadly and obliquely rounded with a low round rim. Surface of the valves is ornamented with several delicate longitudinal ribs. Between the ribs are furrows and in each furrow are two rows of small, closely spaced normal pore openings. Subcentral tubercle is prominent. Muscle scar pattern consists of a vertical row of four irregularly shaped adductors on the posterior side of a muscle depression with a cluster of two or three small scars in front and within the depression. Hingement is holamphidont modified with a prominent subtriangular projection just behind the anterior tooth and socket area of each valve. Dimorphism is not determined.

Dimensions.—Plesiotype no. 6004, a complete carapace from the Moodys Branch greensand at locality 24: length 0.74 mm., height 0.31 mm.

Types.—All types are from the Moodys Branch greensand at locality 24.

Comparisons.—This species is similar to *T. tenuistriata* Apostolescu, 1955, from the Lutetian of the Paris Basin but differs in being more elongate; also the dorsal and ventral margins converge more sharply toward the posterior. This species is referred to the genus *Triginglymus* because of the subtriangular projection behind the anterior tooth in all specimens collected in the Jackson material. This feature is also noted in the only single valve syntype of this species in the Henry V. Howe Collection, Louisiana State University.

Occurrence.—In the Moodys Branch formation greensand member: rare at localities 12, 22 and 24.

TRIGINGLYMUS sp.

Pl. 14, fig. 1

Remarks.—Three valves of this species were found in the Cocoa sand member at locality 31. The specimens are much too large to be assigned to *T. gynthophoreus* Krutak. This species also differs from *T. hyperochus* Blake in carapace outline and ornamentation. It is figured for reference.

Dimensions.—Figured specimen no. 6005, a left valve from the Cocoa sand member at locality 31: length 0.70 mm., height 0.34 mm.

Family LOXOCONCHIDAE Sars, 1925

Genus LOXOCONCHA Sars, 1866

LOXOCONCHA COCOAENSIS Krutak 1961

Pl. 14, figs. 7-10

Loxoconcha cocoaensis Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 774, pl. 93, fig. 2.

Diagnosis.—Surface of the valves is covered by pitted furrows which are aligned in longitudinal rows across the median zone. Both dorsal and ventral margins are obscured by small blade-like ridges which project just above and below the edges respectively.

Brief description.—Carapace is elongate-ovate in lateral view. Dorsal margin is straight and obscured by a small blade-like ridge which projects above the marginal edge; ventral margin is gently convex and also obscured by a blade-like ridge which projects below the margin. Surface of the valves is covered by pitted furrows which tend to align in longitudinal rows across the median zone. Muscle scar consists of four adductor scars in a slightly arcuate row with one or two scars anterior to them. Hingement is gonglyodont.

Dimensions.—Plesiotype no. 6013, a left valve from the North Twistwood Creek clay member at locality 28: length 0.41 mm., height 0.24 mm.

Types.—Plesiotype nos. 6011 and 6014 are from the Cocoa sand member at locality 26; plesiotype no. 6012 is from the Cocoa sand member at locality 31.

Occurrence.—In the Yazoo formation lower beds (facies): rare at localities 6 and 7. In the North Twistwood Creek clay member: rare at localities 22 and 23; common to abundant at locality 28; rare at localities 30 and 31. In the Cocoa sand member: rare at localities 26 and 31.

LOXOCONCHA CONCENTRICA Krutak 1961

Pl. 14, figs. 11-13

Loxoconcha concentrica Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 775, pl. 93, fig. 6; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 12, fig. 8.

Diagnosis.—Surface of the valves is ornamented with coarse pits aligned concentrically with the margins.

Brief description.—Carapace is ovate in lateral view. Dorsal margin is straight; ventral margin is slightly convex. Anterior margin is broadly rounded; posterior is drawn out into a short caudal process. Surface of the valves is covered with coarse pits aligned concentrically and subparallel to the margins. Muscle scar is typical for the genus. Hingement is gonglyodont.

Dimensions.—Plesiotype no. 6016, a right valve from the Cocoa sand member at locality 31: length 0.43 mm., height 0.26 mm.

Types.—Plesiotype nos. 6016 and 6017 are from the Cocoa sand member at locality 31; plesiotype no. 6015 is from the Cocoa sand member at locality 26.

Occurrence.—In the Moodys Branch formation greensand member: rare to common at locality 12; rare at localities 22 and 24. In the upper marl member: rare at localities 10, 11, 17; common at locality 22; rare to common at locality 24. In the Yazoo formation lower beds (facies): common at locality 1; rare at locality 2; rare to common at locality 3; common at localities 4, 5 and 6; rare to common at locality 11. In the Yazoo formation upper beds (facies): rare to common at locality 9; common at locality 15; rare at locality 19. In the North Twistwood Creek clay member: rare at locality 22; common at localities 23, 25

and 28; rare at locality 30; common at locality 31. In the Cocoa sand member: rare to common at localities 26 and 31. In the Pachuta marl member: rare at locality 26. In the Shubuta clay member: common at locality 21; rare at locality 26 and 27.

LOXOCONCHA CREOLENSIS Howe and Chambers 1935

Pl. 14, figs. 14-16

Loxoconcha creolensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 40, 41, pl. 5, fig. 13; Monsour, 1937, AAPG Bull., vol. 21, no. 1, pp. 90, 95 (list); Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125; Brown, 1958, N. C. Dept. Cons. and Dev., Div. Min. Res. Bull. 72, p. 66, pl. 6, fig. 3; Krutak, 1961, Jour Paleo., vol. 35, no. 4, p. 775, pl. 93, fig. 1; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 12, fig. 9.

Loxoconcha cf. L. creolensis Howe and Chambers in Swain, 1948, Maryland Bd. Nat. Res., *Cret. and Tert. Sub. Geol.*, p. 194, pl. 12, fig. 13; Swain, 1951, USGS Prof. Paper 234-A, p. 27, pl. 2, fig. 15.

Diagnosis.—Surface of the valves is covered with moderately coarse pits which tend to align in longitudinal rows. In the ventral portion of the valves weakly developed alae project downward slightly below the ventral margin.

Brief description.—Carapace is small, ovate in lateral view. Dorsal margin is straight to gently convex; ventral margin is slightly convex. Anterior margin is broadly rounded; posterodorsal margin is slightly drawn out with a short caudal process. Surface of the valves is covered with moderately coarse pits which tend to align in longitudinal rows. In the ventral portion of the valves weakly developed alae project downward slightly below the ventral margin. Muscle scar is typical for the genus. Hingement is gonglyodont.

Dimensions.—Plesiotype no. 6018, a carapace from the Moodys Branch greensand at locality 12: length 0.34 mm., height 0.23 mm.

Types.—Plesiotype no. 6018 is from the Moodys Branch greensand at locality 12; plesiotype no. 6019 is from the North Twistwood Creek clay member at locality 31.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 10; rare to common at locality 12; common at localities 22 and 24. In the upper marl member: rare at lo-

calities 10 and 11; common at locality 22; rare at locality 24. In the North Twistwood Creek clay member: rare at localities 20 and 23; rare to common at locality 28; rare at localities 30 and 31. In the Cocoa sand member: rare at localities 26 and 31. In the Pachuta marl member: very rare at localities 26 and 29. In the Shubuta clay member: very rare to rare at locality 26; very rare at locality 27.

LOXOCONCHA JACKSONENSIS Howe and Chambers 1935

Pl. 15, figs. 1-4

Loxoconcha jacksonensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 41, 42, pl. 4, fig. 20; pl. 5, fig. 14; pl. 6, figs. 8, 9; Monsour, 1937, AAPG Bull., vol. 21, no. 1, p. 90; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 109, pl. 11, fig. 18; Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 43; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125; Brown, 1958, N. C. Dept. Cons. and Dev., Div Min. Res. Bull. 72, p. 66, pl. 6, fig. 4; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 775, pl. 93, fig. 9.

Diagnosis.—Carapace is subovate in lateral view. Surface of the valves is sometimes completely covered and sometimes only partially covered with numerous, very tiny, closely spaced pits.

Brief description.—Carapace is subovate in lateral view. Dorsal margin is straight to slightly convex; ventral margin is convex. Anterior margin is broadly rounded; posterodorsal margin is slightly drawn out into a short caudal process. Surface of the valves is sometimes completely covered and sometimes only partially covered with numerous, very tiny, closely spaced pits. Muscle scar is typical for the genus. Hingement is gonglyodont.

Dimensions.—Plesiotype no. 6022, a complete carapace from the Yazoo formation lower beds at locality 6: length 0.50 mm., height 0.30 mm.

Types.—Plesiotype nos. 6022 and 6023 are from the Yazoo formation lower beds at locality 6; plesiotype nos. 6024-6026 are from the Moodys Branch greensand at locality 22.

Occurrence.—In the Moodys Branch formation greensand member: rare at localities 12, 22 and 24. In the upper marl member: abundant at locality 10; common at locality 17; rare at locality 22; common at locality 24. In the Yazoo formation lower beds (facies): common at locality 1; rare to common at locality 2;

common at locality 3; rare to abundant at locality 4; rare at locality 5; common to abundant at locality 6; abundant at locality 7; common at localities 11, 16 and 17. In the Yazoo formation upper beds (facies) : common at localities 9, 14 and 15; rare at locality 18. In the North Twistwood Creek clay member: common at locality 20; rare at locality 22; rare to common at locality 23; rare at locality 25; common at localities 28, 30 and 31. In the Cocoa sand member: rare to common at localities 26 and 31. In the Pachuta marl member: rare at locality 22; common at locality 26; rare at locality 29. In the Shubuta clay member: common at locality 21; rare to abundant at locality 26; common at locality 27.

LOXOCONCHA STAVENSIS Blake 1950

Pl. 14, figs. 17, 18

Loxoconcha stavensis Blake, 1950, Jour. Paleo., vol. 24, p. 182, pl. 30, figs. 10-12.

Diagnosis.—Dorsal and ventral margins are straight and subparallel. Surface of the valves is covered by coarse randomly distributed pits. A weak blade-like ala projects below the ventral margin of each valve.

Brief description.—Carapace is subquadrate in lateral view. Dorsal and ventral margins are straight, subparallel. Surface of the valves is completely covered by coarse, closely spaced, randomly distributed pits. A weak blade-like ala projects slightly below the ventral margin of each valve. Muscle scar is typical for the genus. Hinegment is gonglyodont.

Dimensions.—Plesiotype no. 6020, a right valve from the Moodys Branch greensand at locality 12: length 0.44 mm., height 0.26 mm.

Types.—All types are from the Moodys Branch greensand at locality 12.

Occurrence.—In the Moodys Branch formation greensand member: rare to common at locality 12. In the North Twistwood Creek clay member: rare at localities 28 and 31.

LOXOCONCHA WATERVALLEYENSIS Krutak 1961

Pl. 15, figs. 5, 6

Loxoconcha watervalleyensis Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 775, pl. 93, fig. 3.

Diagnosis.—Dorsal and ventral margins are obscured by small blade-like alae which project above and below each margin respectively. Surface of the valves is smooth except for a few tiny pits in the ventromedian zone.

Brief description.— Carapace is small, ovate in lateral view. Dorsal margin is obscured by a small blade-like ridge which projects above the marginal edge. Ventral margin is gently convex and also obscured by a blade-like ridge which projects below the margin. Surface of the valves is essentially smooth but a few specimens show some tiny pits in the ventromedian zone. Muscle scar is typical for the genus. Hingement is gonglyodont.

Dimensions.—Plesiotype no. 6027, a right valve from the Cocoa sand member at locality 31: length 0.37 mm., height 0.24 mm.

Types.—Plesiotype nos. 6027 and 6028 are from the Cocoa sand member at locality 31; plesiotype no. 6029 is from the North Twistwood Creek clay member at locality 28.

Occurrence.—In the North Twistwood Creek clay member: rare at localities 22, 23 and 25; common to abundant at locality 28; rare at localities 30 and 31. In the Cocoa sand member: common at locality 26; rare at locality 31.

LOXOCONCHA INORNATA n. sp.

Pl. 15, figs. 7-9

Diagnosis.—Carapace is ovate in lateral view. Surface of the valves is smooth, transparent.

Description.— Carapace is small, ovate in lateral view. Dorsal margin is straight to gently convex; ventral margin is convex. Anterior margin is broadly and evenly rounded; posterior margin is drawn out into a short caudal process. Surface of the valves is smooth, transparent.

On the inside, the valves are moderately deep with broad marginal areas. Radial pore canals are few and widely spaced. The line of concrescence lies between the inner and the outer margins at the anterior and posterior. Muscle scar pattern consists of four small adductors in an arcuate row with one or two small scars just anterior to them. Hingement is gonglyodont. Dimorphism is not determined.

Dimensions.—Holotype no. 6030, a complete carapace from the North Twistwood Creek clay member at locality 30: length 0.44 mm., height 0.27 mm.

Types.—Paratype no. 6031 is from the North Twistwood Creek clay member at locality 30; paratype nos. 6032 and 6033 are from the North Twistwood Creek clay member at locality 28.

Comparisons.—This species is easily distinguished from others of the genus by its smooth valve surfaces and lack of alae.

Etymology.—The name inornata means "plain", or not ornamented. The name refers to the smooth unsculptured valve surfaces.

Occurrence.—In the Moodys Branch formation greensand member: very rare at locality 24. In the upper marl member: very rare at locality 10; rare at locality 22. In the Yazoo formation lower beds (facies) : abundant at locality 1. In the Yazoo formation upper beds (facies) : rare at localities 9, 18 and 19. In the North Twistwood Creek clay member: rare at locality 22; common at locality 23; common to abundant at locality 25; common at locality 28; common to abundant at locality 30; rare at locality 31. In the Cocoa sand member: common at locality 26. In the Pachuta marl member: rare at locality 26; very rare at locality 29. In the Shubuta clay member: very rare at locality 26.

LOXOCONCHA YAZOOENSIS n. sp.

Pl. 15, figs. 10-14

Diagnosis.—Carapace is ovate to subrectangular in outline. Surface of the valves is covered by moderately coarse pits which tend to align concentrically with the margins. The rows of pits in the marginal zones are separated by small steep ridges between the rows.

Description.—Carapace of the female is ovate in lateral view; that of the male is subrectangular. Anterior margin is broadly and evenly rounded; posterodorsal margin is slightly extended and more narrowly rounded. Surface of the valves is covered by moderately coarse, closely spaced pits which are aligned concentrically with the margins. Adjacent rows of pits are separated by small steep ridges between the rows except in the median zone of the valves.

On the inside, the valves are moderately deep with broad marginal areas. The line of concrescence lies between the inner and the outer margins at the anterior and posterior margins. Muscle scar consists of a slightly oblique row of four oval-shaped adductors with two (one of which is crescent-shaped and the other oval-shaped) scars anterior to the adductors. Hingement is gonglyodont. Males are more elongate than females.

Dimensions.—Holotype no. 6034, a female right valve from the Yazoo formation lower beds at locality 1: length 0.47 mm., height 0.30 mm.

Types.—Paratype nos. 6035-6037 are from the Yazoo formation lower beds at locality 1; paratype no. 6038 is from the Yazoo formation lower beds at locality 2.

Comparisons.—This species most closely resembles *L. clarkensis* Blake 1950, but differs in being less quadrate in outline and more coarsely pitted than *L. clarkensis*. *L. yazooensis* n. sp. differs from *L. concentrica* Krutak, 1961, in having a larger carapace and much coarser pits; it is also slightly more quadrate in lateral view than *L. concentrica*.

Etymology.—This species is named for the city of Yazoo City, Mississippi, location of the type section of the Yazoo formation.

Occurrence. — In the Moodys Branch formation upper marl member: very rare at locality 17. In the Yazoo formation lower beds (facies): common at locality 1; rare to common at locality 2; common at locality 3; rare at locality 4; common at locality 5; rare at locality 6; common at locality 11; very rare at locality 17. In the Yazoo formation upper beds (facies): rare at locality 14; common at locality 18. In the Pachuta marl member: very rare at localities 22 and 29.

Genus CYTHEROMORPHA Hirschman, 1909

CYTHEROMORPHA CALVA Krutak 1961

Pl. 15, figs. 15-18

Cytheromorpha calva Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 781, pl. 93, fig. 5.

Diagnosis. — Carapace is elongate-subovate in lateral view. Surface of the valves is smooth, transparent to translucent.

Brief description. — Carapace is elongate-subovate in lateral view. Dorsal and ventral margins are nearly straight and converge slightly toward the posterior. Anterior margin is broadly and evenly rounded with a thin compressed rim. Anteroventral margin extends slightly below the line of the venter. Surface of the valves is smooth, transparent to translucent. Muscle scar consists of a slightly oblique row of four oval-shaped adductors with one scar just anterior to them. Hingement is gonglyodont. Males are more elongate than females.

Dimensions. — Plesiotype no. 6039, a male carapace from the North Twistwood Creek clay member at locality 30: length 0.57 mm., height 0.24 mm.

Types. — All types are from the North Twistwood Creek clay member at locality 30.

Occurrence. — In the Moodys Branch formation greensand member: rare at localities 22 and 24. In the upper marl member: very rare at localities 17 and 22. In the Yazoo formation lower beds (facies): rare to common at locality 1; rare at localities 2, 3 and 4; rare to common at locality 5; rare at locality 6; rare to common at locality 11; rare at localities 16 and 17. In the North Twistwood Creek clay member: rare at locality 20; common to abundant at localities 22 and 23; common at localities 25 and 28; common to abundant at locality 30. In the Cocoa sand member: rare to common at locality 26; rare at locality 31. In the Pachuta marl member; rare at locality 26.

CYTHEROMORPHA OUACHITAENSIS

Howe and Chambers 1935

Pl. 15, figs. 19-22

Cytheromorpha ouachitaensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 44, 45, pl. 5, fig. 8; pl. 6, figs. 4, 5; Monsour, 1937, AAPG Bull., vol. 21, no. 1, p. 90; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 109, pl. 11, fig. 19.

Diagnosis.—Surface of the valves is covered by a network of pits which tend to align in rows concentric with the margins.

Brief description. — Carapace is elongate-ovate in lateral view. Dorsal and ventral margins are nearly straight and converge toward the posterior. Anterior margin is broadly and evenly rounded with a small compressed rim. Posterior margin is narrower and more evenly rounded. Anteroventral margin extends slightly below the venter. Surface of the valves is covered by a network of pits which tend to align in rows concentric with the margins. Muscle scar consists of a vertical row of four small adductors with one small round scar anterior to them. Hingement is gonglyodont. Males are more elongate than females.

Dimensions. — Plesiotype no. 6043, a male carapace from the Yazoo formation upper beds at locality 18: length 0.51 mm., height 0.23 mm.

Types. — All types are from the Yazoo formation upper beds at locality 18.

Occurrence. — In the Yazoo formation lower beds (facies): rare to common at locality 1; rare at localities 6, 7 and 17. In the Yazoo formation upper beds (facies): rare at localities 9, 15, 18 and 19. In the North Twistwood Creek clay member: common at locality 20; rare at localities 22, 28 and 30. In the Cocoa sand member: rare at localities 26 and 31. In the Pachuta marl member: rare at localities 22, 26 and 29.

CYTHEROMORPHA ASPERATA n. sp.

Pl. 15, figs. 23-26

Diagnosis. — Dorsal margin is straight; ventral margin is slightly concave. Surface of the valves is rough and covered

by an irregular pattern of reticles. A low rounded ridge extends from the anteroventral zone to a point near the posteroventral zone.

Description. — Carapace is elongate-ovate in lateral view. Dorsal margin is straight; ventral margin is slightly concave. Both margins converge slightly toward the posterior. Anterior margin is broadly and evenly rounded with a narrow compressed rim; posterior margin is evenly rounded. Surface of the valves is rough and covered by an irregular pattern of reticles. A low rounded ridge extends from the anteroventral zone to a point near the posteroventral zone.

On the inside, the valves are shallow with moderately broad marginal areas. Radial pore canals are few and widely spaced. The line of concrescence lies between the inner and outer margins at the anterior and posterior margins. Muscle scar pattern consists of a vertical row of four small elongate adductors with two small scars in front. Hingement is gonglyodont. Males are more elongate and less pyriform in outline than females.

Dimensions. — Holotype no. 6046, a male left valve from the North Twistwood Creek clay member at locality 31: length 0.44 mm., height 0.21 mm.

Types. — All types are from the North Twistwood Creek clay member at locality 31.

Etymology. — Asperata means "rough" which describes the rough, uneven surfaces of the valves of this species.

Occurrence. — In the Yazoo formation lower beds (facies) : very rare at locality 1. In the North Twistwood Creek clay member: common at locality 28; rare at locality 30; rare to common at locality 31. In the Cocoa sand member: rare at locality 26; very rare at locality 31. In the Pachuta marl member: very rare at locality 29.

Family TRACHYLEBERIDIDAE Sylvester-Bradley, 1948

Genus TRACHYLEBERIS Brady, 1898

TRACHYLEBERIS MONTGOMERYENSIS

(Howe and Chambers) 1935

Pl. 16, figs. 1-4

Cythereis montgomeryensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 37, pl. 1, figs. 13, 16; pl. 2, figs. 22, 23; pl. 6, figs. 19, 20; Garrett, 1936, Jour. Paleo., vol. 10, p. 786; Monsour, 1937, AAPG Bull., vol. 21, pp. 90, 95; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 108, pl. 11, figs. 15, 16; Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 43; Stephenson, 1944, Jour. Paleo., vol. 18, no. 5, pp. 450, 451, pl. 76, fig. 7; Bold, 1950, Jour. Paleo., vol. 24, no. 1, p. 108; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125, pl. 1, fig. 12.

Trachyleberis (?) montgomeryensis (Howe and Chambers) in Puri, 1953, Am. Mid. Nat., vol. 49, p. 176, pl. 1, figs. 4, 5, text figs. A, B.

Trachyleberis montgomeryensis (Howe and Chambers) in Brown, 1958, N. C. Dept. Cons. and Dev., Div. Min. Res. Bull. 72, p. 62, pl. 3, fig. 8; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 784, pl. 91, fig. 3; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 14, figs. 9, 10, 13.

Diagnosis.—Carapace is large, elongate, subquadrate in lateral view. Surface of the valves is ornamented by irregularly distributed, vertically-tapering spines. Most specimens have a cluster of spines in the anteromedian zone which are separated from the others by a small, arcuate-shaped, smooth area.

Brief description.—Carapace is large, elongate, subquadrate in lateral view. Surface of the valves is ornamented with irregularly distributed, vertically tapering spines. Most specimens have a cluster of spines in the anteromedian zone which are separated from the others by a small, arcuate-shaped, smooth area. There are some smooth areas in the posterior and anterior marginal zones where the spines are more widely spaced. Muscle scar consists of a vertical row of four adductors on the posterior edge of the muscle depression with two scars anterior to them on the anterior edge of the depression. Hingement is holamphidont. Males are more elongate than females.

Dimensions.—Plesiotype no. 6050, a male right valve from the Shubuta clay member at locality 26: length 1.01 mm., height 0.50 mm.

Types.—Plesiotype nos. 6049 and 6050 are from the Shubuta clay member at locality 26; plesiotype nos. 6048 and 6051 are from the Moodys Branch greensand at locality 12.

Occurrence.—Common, abundant, rare to common, rare to abundant or common to abundant in all stratigraphic levels and found at essentially all localities of the Jackson group in Mississippi.

TRACHYLEBERIS MONTGOMERYENSIS BISPINOSA

n. subsp.

Pl. 16, figs. 5-9

Diagnosis.—Carapace is heavy, elongate, subquadrate in lateral view. Surface of the valves is ornamented by a thick cover of irregularly arranged, sharp, vertically-tapering spines. There are two strong spines in the posterodorsal zone which project noticeably above the others.

Description. — Carapace is heavy, elongate, subquadrate in lateral view. Dorsal margin is straight with a row of sharp spines projecting above the edge; ventral margin is straight to slightly convex. Both margins tend to converge posteriorly. Anterior margin in broadly and obliquely rounded with a heavy rim which is fringed with a double row of denticles. Posterior margin is compressed, angulated at mid-posterior, straight in the dorsal part, rounded and spinose in the ventral part. Surface of the valves is ornamented by a thick cover of irregularly arranged, sharp, vertically-tapering spines. There are two strong spines in the posterodorsal zone which project noticeably above the others.

On the inside, the valves are shallow with broad marginal areas. Radial pore canals are numerous, wavy, sometimes branched. They may occur singly or in pairs. The line of concrescence coincides with the inner margin throughout. Muscle scar pattern consists of four elongate adductors in an arcuate row on the posterior side of a shallow muscle depression with a cluster of two or three smaller scars anterior to them within the depression. Hingement is holamphidont. Males are more elongate than females.

Dimensions. — Holotype no. 6055, a female carapace from the North Twistwood Creek clay member at locality 30: length 0.83 mm., height 0.50 mm., thickness 0.36 mm.

Types. — All types are from the North Twistwood Creek clay member at locality 30.

Etymology.—The name bispinosa, meaning "two spines", is suggested by the two prominent spines which project above the others in the posterodorsal zone of the valves.

Occurrence. — In the Moodys Branch formation greensand member: rare at localities 10 and 12; rare to common at locality 24. In the upper marl member: abundant at localities 10 and 22. In the Yazoo formation lower beds (facies): common to abundant at locality 1; common at locality 11. In the North Twistwood Creek clay member: rare to abundant at localities 20 and 22; abundant at locality 23; rare to common at locality 25; abundant at locality 28; common to abundant at locality 30; rare to abundant at locality 31. In the Cocoa sand member: common at localities 26 and 31. In the Pachuta marl member: common at locality 26; rare to common at locality 29. In the Shubuta clay member: common to abundant at localities 26 and 27.

Genus ACTINOCYTHEREIS Puri, 1953

ACTINOCYTHEREIS GIBSONENSIS

(Howe and Chambers) 1935

Pl. 16, figs. 10, 11; Pl. 17, figs. 1, 2

Cythreis gibsonensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 29, pl. 1, fig. 22; pl. 6, figs. 21, 22; Garrett, 1936, Jour. Paleo., vol. 10, p. 786; Monsour, 1937, AAPG Bull., vol. 21, no. 1, p. 89 (list); Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 107, pl. 11, figs. 9, 10; Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 43.

Actinocythereis gibsonensis (Howe and Chambers) in Puri, 1953, Am. Mid. Nat., vol. 49, p. 182, pl. 2, figs. 11, 12; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, pp. 782, 783, pl. 91, figs. 4; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 14, fig. 6.

Diagnosis. — Carapace is elongate-ovate in lateral view. Surface ornamentation of the valves consists of an arcuate longitudinal median row of five spines and a ventral row of five spines which converge in the posteromedian zone. A blade-like rim extends around the upper three-fifths of the anterior margin.

Brief description. — Carapace is elongate-ovate in lateral view. Dorsal and ventral margins are straight and converge gently toward the posterior. Eye tubercles are conspicuous, glassy and attached to a blade-like rim which extends around the upper three-fifths of the anterior margin. Surface ornamentation consists of an arcuate longitudinal median row of five spines and a ventral row of five spines which tend to converge in the

posteromedian zone. Muscle scar consists of a vertical row of four oval-shaped adductors with two scars anterior to them. Hingement is holamphidont. Males are more elongate than females.

Dimensions. — Plesiotype no. 6057, a female right valve from the Cocoa sand member at locality 26: length 0.67 mm., height 0.36 mm.

Types. — All types are from the Cocoa sand member at locality 26.

Comparisons. — This species differs from *A. exanthemata* (Ulrich and Bassler), 1904, by the character of the spines on the valve surfaces and the shape of the posterior margin.

Remarks. — The right valve on the cotype slide 807, Henry V. Howe Collection, Louisiana State University, is designated as the lectotype of this species.

Occurrence. — In the Moodys Branch formation greensand member: very rare at locality 12. In the upper marl member: rare at locality 22; rare to common at locality 24. In the Yazoo formation lower beds (facies): common at locality 2; rare at locality 3; common at localities 4 and 5. In the Yazoo formation upper beds (facies): rare at locality 8; abundant at localities 9, 14 and 15; common to abundant at locality 18. In the North Twistwood Creek clay member: abundant at locality 20; rare to common at locality 22; common at locality 23; abundant at localities 25, 28, 30 and 31. In the Cocoa sand member: common at localities 26 and 31.

ACTINOCYTHEREIS GRIGSBYI (Howe and Chambers) 1935

Pl. 17, figs. 3-5

Cythereis grigsbyi Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 30, 31, pl. 1, figs. 17, 18; pl. 2, fig. 20; pl. 6, fig. 6; Monsour, 1937, AAPG Bull., vol. 21, p. 89; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 124, pl. 1, fig. 13.

Trachyleberis (?) grigsbyi (Howe and Chambers) in Puri, 1953, Am. Mid. Nat., vol. 49, pp. 176, 177, pl. 1, figs. 9, 10.

Diagnosis. — Surface of the valves is ornamented by a median row and a ventral row of nodes. The median row begins in the

lower anteromedian zone and extends into the posteromedian zone. The ventral row, below and parallel to the median row, extends from the anteroventral angle to the posteroventral zone. An arcuate-shaped sinus separates an anteromedian cluster of nodes from the others in the median row.

Brief description. — Carapace is elongate-ovate in lateral view. Dorsal margin is straight; ventral margin is straight to sinuate. Both margins converge gently toward the posterior. Surface of the valves is nodose. A median row of nodes begins in the lower anteromedian zone and extends back and into the posteromedian zone. A ventral row extends, parallel to the median row, from the anteroventral angle to the posteroventral zone. An arcuate sinus, slightly anterior to the median zone, separates an anteromedian cluster of nodes in the median row from the others. Muscle scar is typical for the genus. Hingement is holamphidont. Males are more elongate than females.

Dimensions. — Plesiotype no. 6061, a female left valve from the Cocoa sand member at locality 26: length 0.71 mm., height 0.43 mm.

Types. — Plesiotype no. 6060 is from the Cocoa sand member at locality 31; plesiotype no. 6061 is from the Cocoa sand member at locality 26.

Comparisons. — The cotypes of this species have been examined and they show sufficient lineation of the surface nodes to warrant assignment of this species to the genus *Actinocythereis* instead of *Trachyleberis*.

Remarks. — The right valve on cotype slide no. 810, Henry V. Howe Collection, Louisiana State University, is designated as the lectotype of this species.

Occurrence. — In the Yazoo formation lower beds (facies): common to abundant at localities 1, 2 and 3; common at locality 4; common to abundant at locality 5; abundant at locality 13; rare at locality 17. In the Yazoo formation upper beds (facies): common at locality 8; common to abundant at locality 9; common at locality 18; rare at locality 19. In the Cocoa sand member: rare to common at locality 26; common at locality 31.

ACTINOCYTHEREIS BOLDI n. sp.

Pl. 17, figs. 6-10

Diagnosis. — Dorsal margin is straight and fringed by a row of five spines with tips which are swept back posteriorly. Surface of the valves is ornamented by two rows of long, vertically-tapering spines. A median row of four spines, convex dorsally, forms an arc across the median zone; a ventral row of four spines extends across the ventromedian zone. The two rows of spines tend to converge posteriorly.

Description. — Carapace is elongate-ovate in lateral view. Dorsal margin is straight and fringed by a row of five sharp spines with their tips swept back posteriorly. Ventral margin is sinuate and fringed with a row of short blunt spines. Both margins converge toward the posterior. Anterior margin is broadly rounded, compressed, and fringed with a double row of denticles. The radial pore canals are visible in the compressed marginal zones. Eye tubercles are conspicuous, glassy, and connected to a short blade-like anteroventral ridge. Posterior margin is compressed and angulated at midposterior; straight in the dorsal part, rounded with several long sharp spines in the ventral part. Surface of the valves is ornamented by two rows of long, vertically-tapering, sometimes flattened, spines. A median row of four spines forms an arc, convex dorsally, across the median zone; a ventral row of four spines extends across the ventromedian zone. The two rows tend to converge posteriorly.

On the inside, the valves are shallow with very broad marginal areas, especially at the anterior. Radial pore canals are numerous, long, sometimes wavy and bifurcating, and occur singly or in bundles of two or more, closely spaced. The line of concrescence coincides with the inner margin throughout. Muscle scar consists of four small oval-shaped adductors on the posterior edge of the muscle depression with one U-shaped scar anterior to them within the depression. Hingement is holamphidont. Males are more elongate than females.

Dimensions. — Paratype no. 6064, a male left valve from the Shubuta clay member at locality 26: length 0.76 mm., height 0.36 mm.

Types. — All types are from the Shubuta clay member at locality 26.

Comparisons. — This species differs from *Trachyleberis* (?) *davidwhitei* (Stadnichenko), 1927, from the Weches (Claiborne) of Texas in that the dorsal row of spines of *T.* (?) *davidwhitei* is coarser, the median row is more strongly arched. The ventral row has five spines instead of four and the two spines of the ventral part of the posterior margin are not as prominent as in *A. boldi* n. sp. It differs from *A. gibsonensis* (Howe and Chambers) in that the anterior marginal zones in *A. boldi* n. sp. are more compressed and the radial pore canals are visible. The two species also differ in number and arrangement of surface spines of the median and ventral rows and also the configuration of the dorsal spines.

Etymology. — This species is named in honor of Dr. William A. van den Bold, Louisiana State University, Baton Rouge, Louisiana.

Occurrence. — In the Moodys Branch formation greensand member: rare at locality 10; common to abundant at locality 12; common at localities 20, 22 and 24. In the upper marl member: abundant at locality 10; rare to common at locality 11; rare at locality 17; common at localities 22 and 24. In the Yazoo formation lower beds (facies): common to abundant at localities 1 and 2; rare to common at localities 3 and 4; common at localities 5, 6 and 7; common to abundant at locality 11; rare at locality 13; rare to common at localities 16 and 17. In the Yazoo formation upper beds (facies): rare to common at locality 9; abundant at localities 14 and 15; rare at locality 18. In the North Twistwood Creek clay member: common at localities 20 and 22; common to abundant at locality 23; common at locality 25; rare at locality 28; rare at locality 30; common at locality 31. In the Cocoa sand member: rare to common at locality 26; rare at locality 31. In the Pachuta marl member: rare at locality 22; common at localities 26 and 29. In the Shubuta clay member: common at localities 21 and 26; rare at locality 27.

ACTINOCYTHEREIS NODOSA n. sp.

Pl. 17, figs. 11-13

Diagnosis. — Surface of the valves is ornamented by nodes. There are two large, rounded elongate nodes in the median row and five or six small nodes, tending to coalesce, in a ventral row below the median row.

Description. — Carapace is heavy, elongate-subquadrate in lateral view. Dorsal margin is straight with four or five short spines projecting above the edge; ventral margin is slightly sinuate. Both margins converge gently toward the posterior. Anterior margin is broadly and obliquely rounded with a raised rim fringed with a double row of denticles. Posterior margin is compressed, angulated at midposterior; straight to slightly concave at posterodorsum; rounded with a double row of moderately long sharp spines in the posteroventral part. Greatest height is at the anterior cardinal angle; greatest thickness is slightly postmedian. Surface of the valves is nodose. There are two large, rounded elongate nodes in a median row and five or six smaller nodes, tending to coalesce, in a ventral row below the median row.

On the inside, the valves are shallow with broad marginal areas. Selvage is strong. Radial pore canals are numerous, long, and occur in bundles of two or more. The line of concrescence coincides with the inner margin throughout. Muscle scar consists of four small adductors on the posterior edge of the muscle depression with two small scars anterior to them within the depression. Hingement is holamphidont. Dimorphism is not determined.

Dimensions. — Holotype no. 6069, a right valve from the Moodys Branch greensand member at locality 12: length 0.80 mm., height 0.43 mm.

Types. — Paratype nos. 6068, 6070, 6071 are from the Moodys Branch greensand at locality 12; paratype no. 6072, a carapace, is from the Moodys Branch greensand at locality 10.

Comparisons. — This species differs from *A. purii* in the size, arrangement and shape of the median nodes; also by the coalescement of the ventral nodes. It differs from *Cythereis elmana*

Stadnichenko, 1927, from the Weches (Claiborne) of Texas by the absence of a round ridge near the dorsal margin which is present on *C. elmana*. Also, the valves of *A. nodosa* are more compressed than those of *C. elmana*.

Etymology. — Nodosa means "containing nodes" and this describes the large nodes that ornament the valve surface of this species.

Occurrence. — In the Moodys Branch formation greensand member: rare to common at locality 10; common at locality 11 rare at locality 12. In the upper marl member: rare at locality 10; common at locality 11; rare at locality 24. In the Yazoo formation lower beds (facies): very rare at locality 6.

ACTINOCYTHEREIS PURII n. sp.

Pl. 18, figs. 1-6

Actinocythereis n. sp. 1. Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 14, fig. 7.

Diagnosis. — Surface of the valves is ornamented by two rows of large round nodes. A median row with one large, elongate node and two smaller nodes extends across the median zone. A ventral row of four or five small round nodes extends across the ventral region parallel to the median row. On some specimens there are one or two nodes in between the rows.

Description. — Carapace is heavy, elongate-ovate in lateral view. Dorsal margin is straight with a row of four or five sharp spines projecting above the edge. Ventral margin is straight to slightly convex. Anterior margin is broadly and obliquely rounded with a raised rim fringed with a double row of denticles. Posterior margin is compressed, angulated at mid-posterior; obliquely rounded and spinose in the posteroventral part. Greatest height is at the anterior cardinal angle; greatest thickness is slightly postmedian. Surface of the valves is ornamented by two rows of large and round nodes. A median row with a large elongate node and two smaller nodes extends across the median zone. A ventral row of four or five small round nodes extends across the ventral zone parallel to the median row. On some specimens one or two nodes may be present between the two main rows.

On the inside, the valves are shallow with broad marginal areas. Selvage is strong. Radial pore canals are numerous, wavy, and occur in bundles of two or more. The line of concrescence coincides with the inner margin throughout. Muscle scar pattern consists of four small oval-shaped adductors on the posterior edge of the subcentral muscle depression with a cluster of three or four small scars anterior to them within the depression. Hingement is holamphidont. Males are more elongate than females.

Dimensions. — Holotype no. 6076, a female carapace from the Shubuta clay member at locality 26: length 0.86 mm., height 0.46 mm., thickness 0.43 mm.

Types. — Paratype nos. 6073-6075 are from the Shubuta clay member at locality 26; paratype nos. 6077 and 6078 are from the Pachuta marl member at locality 26.

Etymology. — This species is named in honor of Dr. Harbans S. Puri of the Geological Survey of Florida, Tallahassee, Florida.

Occurrence. — In the Moodys Branch formation greensand member: very rare at locality 24. In the upper marl member: rare at localities 10, 17 and 24. In the Yazoo formation lower beds (facies): rare to common at localities 1 and 2; common to abundant at locality 3; common at locality 4; common to abundant at locality 13; rare to common at locality 16; rare at locality 17. In the Yazoo formation upper beds (facies): common at locality 9; rare at localities 14 and 15. In the Pachuta marl member: common at locality 20; rare to common at locality 22; common at localities 26 and 29. In the Shubuta clay member: rare at locality 21; common to abundant at locality 26; rare at localities 27 and 29.

Genus ACANTHOCYTHEREIS Howe, 1963

ACANTHOCYTHEREIS HOWEI n. sp.

Pl. 18, figs. 7-11

Trachyleberis n. sp. 1 Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 14, figs. 11, 12.

Diagnosis.—Surface of the valves is well covered with reticles and spines. Some of the spines project from the reticle corners.

Dorsal and ventral margins are straight and essentially parallel; the dorsal margin has a row of blunt spines projecting above the edge.

Description. — Carapace is large, slightly tumid, elongate-ovate in lateral view. Dorsal and ventral margins are essentially straight and parallel; dorsal margin has a row of blunt spines projecting above the edge. Anterior margin is broadly and obliquely rounded with a heavy rim fringed with a double row of denticles. A sharp blade-like rim extends around the antero-dorsal margin from the eye tubercle to about one-third the distance around the margin and a row of small, blunt vertical denticles occupy the remainder of the marginal distance. Posterior margin is obtusely angulated above the middle, slightly concave in the dorsal part, slightly convex, with several short spines, in the ventral part. Surface of the valves is reticulospinose with some small spines occurring at the reticle corners. On some female valves there is a slight suggestion of alignment of some of the spines into two longitudinal rows as in *Henryhowella*. In the male forms there is no discernible alignment of the reticles and spines.

On the inside, the valves are moderately deep with broad marginal areas. Selvage is strong. Radial pore canals are numerous, long, sometimes wavy and bifurcating. They occur singly or in pairs, closely spaced. This line of concrescence coincides with the inner margin throughout. Muscle scar pattern consists of a row of four oval-shaped adductors on the posterior edge of a subcentral muscle depression with a cluster of two or three small, round scars anterior to them within the depression. Hingement is holamphidont. Dimorphism is marked. Males are considerably more elongate than females and show some difference in surface ornamentation.

Dimensions. — Holotype no. 6080, a female left valve from the Shubuta clay member at locality 26: length 0.93 mm., height 0.54 mm.

Types.—All types are from the Shubuta clay member at locality 26.

Comparisons. — This species differs considerably from *Henryhowella florienensis* (Howe and Chambers) by its large size,

greater thickness, and more nearly parallel dorsal and ventral margins. The surface ornamentation also differs from species of *Henryhowella* in that the spines or reticles do not occur as distinctly in subparallel rows as in the latter. This is especially true of the males.

Etymology. — This species is named in honor of Dr. Henry V. Howe, Director Emeritus, School of Geology, Louisiana State University, Baton Rouge, Louisiana.

Occurrence. — In the Yazoo formation upper beds (facies): common at localities 14 and 18. In the Pachuta marl member: rare at locality 29. In the Shubuta clay member: abundant at locality 21; common to abundant at locality 26; abundant at locality 27; common at locality 29.

Genus HENRYHOWELLA Puri, 1957

HENRYHOWELLA FLORIENENSIS

(Howe and Chambers) 1935

Pl. 19, figs 1-5.

Cythereis florienesis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 28, 29, pl. 1, fig. 14; Garrett, 1936, Jour. Paleo., vol. 10, p. 786; Monsour, 1937, AAPG Bull., vol. 21, pp. 89, 96; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 106, pl. 11, fig. 8; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125, pl. 1, fig. 16.

Cythereis deusseni Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 27, pl. 1, fig. 15; pl. 6, figs. 2, 3.

Henryhowella florienensis (Howe and Chambers) in Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 784, pl. 91, fig. 8; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 13, figs. 11, 12.

Trachyleberis florienensis (Howe and Chambers) in Pooser, 1965, Univ. Kans. Paleo. Contr. Art. 8, p. 53, pl. 21, figs. 4, 6, 7.

Diagnosis.—Surface of the valves is ornamented by two spinose ridges. A median ridge extends from the subcentral tubercle to the midposterior zone. A ventral ridge, subparallel to the median ridge, extends from the anteroventral zone to a point near the posteroventral zone. Subcentral tubercle is covered by a thick cluster of small spines and separated from the median ridge by an arcuate row of large reticles.

Brief description.—Carapace is elongate-ovate in lateral view. Dorsal margin is straight with a row of short, blunt spines projecting above the edge. Surface of the valves is ornamented by two broad spinose ridges. The median ridge extends from near the midposterior zone to the subcentral tubercle and the ridge near venter extends from the anteroventral zone to a point near the posteroventral zone. The subcentral tubercle is covered by a thick cluster of small spines and separated from the median ridge by an arcuate row of large reticles. Muscle scar consists of a vertical row of four small adductors on the posterior edge of the muscle depression with two small scars anterior to them within the depression. Hingement is holamphidont. Males are more elongate than females.

Dimensions.—Plesiotype no. 6085, a male left valve from the Shubuta clay member at locality 27: length 0.81 mm., height 0.40 mm.

Types.—Plesiotype nos. 6086, 6087 are from the Yazoo formation upper beds at locality 18; plesiotype no. 6088 is from the North Twistwood Creek clay member at locality 23; plesiotype nos. 6084, and 6089 are from the Shubuta clay member at locality 26; plesiotype nos. 6085 and 6090 are from the Shubuta clay member at locality 27.

Remarks.—The left valve on cotype slide no. 806, Henry V. Howe Collection, Louisiana State University, is designated as the lectotype of this species. Pachuta marl member and Shubuta clay member specimens of this species are slightly larger than those from the Yazoo formation of the west-central counties.

Occurrence.—Common, abundant, rare to abundant or common to abundant in all stratigraphic levels and found at essentially all localities of the Jackson group in Mississippi.

Genus HIRSUTOCYTHERE Howe, 1951

HIRSUTOCYTHERE HORNOTINA Howe 1951

Pl. 19, figs. 6, 7

Hirsutocythere hornotina Howe, 1951, Fla. Geol. Surv. Bull. 34, p. 22, pl. 4, figs. 3, 6, 9, 12.

Diagnosis.—Carapace is slightly tumid. Surface of the valves is completely and thickly covered with spines. Marginal areas are very broad with long, straight, fine radial pore canals which extend into the marginal spines.

Brief description.—Carapace is slightly tumid, elongate-ovate in lateral view. Surface of the valves is completely and thickly covered with spines.

On the inside, the marginal areas are very broad with long, straight, fine radial pore canals which extend into the marginal spines. Muscle scar consists of a vertical row of four oval-shaped adductors on the posterior edge of the muscle depression with one scar anterior to them within the depression. Hingement is holamphidont. Dimorphism not certain but some forms are slightly more elongate than others and may be the males.

Dimensions.—Plesiotype no. 6091, a right valve from the Moodys Branch greensand at locality 24: length 0.74 mm., height 0.44 mm.

Types.—All types are from the Moodys Branch greensand at locality 24.

Occurrence.—In the Moodys Branch formation greensand member: rare at localities 12 and 22; rare to common at locality 24.

Genus ECHINOCYTHEREIS Puri, 1953

ECHINOCYTHEREIS JACKSONENSIS

(Howe and Pyeatt) 1935

Pl. 19, figs. 8, 9

Cythereis (?) jacksonensis Howe and Pyeatt in Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 35, 36, pl. 1, figs. 23, 24; pl. 4, fig. 31; Monsour, 1937, AAPG Bull, vol. 21, p. 90; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 108, pl. 11, fig. 14; Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 43.

Cythereis jacksonensis Howe and Pyeatt in Garrett, 1936, Jour. Paleo., vol. 10, p. 786; Bold, 1946, *Contribution to the Study of Ostracoda*, Utrecht University, J. H. DeBussy, Amsterdam, p. 89, pl. 10, fig. 7; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125, pl. 1, fig. 14.

Echinocythereis jacksonensis (Howe and Pyeatt) in Puri, 1953, Fla. Geol. Surv. Bull. 36, p. 260; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, pp. 783, 784, pl. 91, fig. 9; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 14, fig. 18; Pooser, 1965, Univ. Kans. Paleo. Contr. Art. 8, p. 58, pl. 15, figs. 7, 10-13.

Diagnosis.—Carapace is tumid. Surface is reticulo-spinose with the reticles and spines arranged more or less in rows concentric with the margins.

Brief description.—Carapace is tumid, elongate-ovate in lateral view. Surface of the valves is reticulo-spinose. The reticles and spines are arranged in a polygonal pattern and tend to align in rows concentric with the margins. Muscle scar consists of a vertical row of four adductors with two scars anterior to them. Hingement is holamphidont. Males are more elongate than females.

Dimensions.—Plesiotype no. 6094, a male left valve from the Moodys Branch greensand at locality 24: length: 1.00 mm., height 0.56 mm.

Types.—Plesiotype nos. 6093, 6095 are from the Moodys Branch greensand at locality 12.

Occurrence.—Rare, abundant, rare to common, rare to abundant or common to abundant in all stratigraphic levels and found at all localities of the Jackson group in Mississippi.

ECHINOCYTHEREIS aff. E. NUDA Puri 1957

Pl. 19, figs. 10, 11

Remarks.—This species differs from *E. jacksonensis* only by the smooth surface of its valves. It is closely related to *E. nuda* Puri but is slightly more elongate.

Dimensions.—Plesiotype no. 6096, a male carapace from the Pachuta marl member at locality 29: length: 0.94 mm., height 0.51 mm.

Occurrence.—In the Yazoo formation lower beds (facies) : rare at localities 3 and 11. In the North Twistwood Creek clay member: rare at locality 28. In the Pachuta marl member: rare at localities 22 and 29. In the Shubuta clay member: rare to common at locality 26; rare at locality 29.

Genus BUNTONIA Howe, 1935

BUNTONIA SHUBUTAENSIS Howe 1935

Pl. 20, figs. 1-5

Buntonia shubutaensis Howe in Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 23, 24, pl. 4, figs. 4, 5; pl. 5, fig. 7; Monsour, 1937, AAPG Bull., vol. 21, p. 89; Howe, 1947, Soc. Econ. Paleontologists and Mineralogists-Geophysics Joint Ann. Meeting, p. 50; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125; Pokorny, 1958, *Grundzüge Der Zoologischen Mikropalaontologie*, Band II, p. 270; Reyment and Elofson, 1959, Stockholm, Contr. in Geol., vol. 3, no. 9, pp. 161, 162, pl. 1, figs. 2, 4, 6; pl. 2, fig. 2; pl. 3, figs. 3, 4; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 783, pl. 93, fig. 15; *Treatise on Invertebrate Paleontology (Q) Arthopoda*, 1961, p. Q366, fig. 260; figs. 1 a-d.

Cythereis (?) israelskyi Howe and Pyeatt in Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 33, 34, pl. 1, figs. 19-21; pl. 4, figs. 7-9; Monsour, 1937, AAPG Bull., vol. 21, p. 90.

Cythereis israelskyi Howe and Pyeatt in Garrett, 1936, Jour. Paleo., vol. 10, p. 786; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 107, pl. 11, fig. 12.

Pyricythereis israelskyi Howe and Pyeatt in Howe and Law, 1936, La. Dept. Cons. Geol. Bull. 7, pp. 65, 66.

Pyricythereis cf. israelskyi Howe and Pyeatt in McLean, 1947, Phil. Acad. Sci. Nat. Natur. no. 200, p. 8.

Buntonia israelskyi (Howe and Pyeatt) in Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 12, fig. 7.

Diagnosis. — Carapace is subpyriform in side view. Inflated portion of the valves is ornamented with small longitudinal ribs which are intersected transversely by riblets. Remainder of the valve surface is smooth.

Brief description.—Carapace subpyriform is lateral view. Valves are inflated postmedially. Inflated posterior is ornamented with small longitudinal ribs which are intersected, in most specimens, by transverse riblets. Remainder of the valve surface is smooth. Muscle scar consists of a vertical row of four oval-shaped adductors with a V-shaped antennal scar, and another scar below it, anterior to them. Hingement is holamphidont. Males are more elongate than females.

Dimensions.—Plesiotype no. 6099, a male right valve from the Shubuta clay member at locality 26: length 0.51 mm., height 0.26 mm.

Types.—Plesiotype nos. 6097 - 6100 are from the Shubuta clay member at locality 26; plesiotype no. 6101, a young molt, is from the North Twistwood Creek clay member at locality 30.

Remarks.—The left valve on cotype slide no. 1144, Henry V. Howe Collection, Louisiana State University, is designated as the lectotype of this species.

Occurrence.—Common, rare to common, rare to abundant or common to abundant in all stratigraphic levels and found at essentially all localities of the Jackson group in Mississippi.

BUNTONIA MORESI (Howe and Pyeatt) 1935

Pl. 20, figs. 6-8

Cythereis (?) israelskyi var. morsei Howe and Pyeatt in Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 34, 35, pl. 3, figs. 11, 12; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 108, pl. 11, fig. 1.

Diagnosis.—Carapace is subpyriform in lateral view. Surface of the valves is completely covered by coarse pits with the pits aligned in parallel rows on the inflated portion of the valves.

Brief description.—Carapace is small, subpyriform in lateral view. Valves are inflated postmedially. Surface is completely covered by coarse pits which tend to align in parallel rows on the inflated regions of the valves. Muscle scar is typical for the genus. Hingement is holamphidont. Males are more elongate than females.

Dimensions.—Plesiotype no. 6104, a female carapace from the Yazoo formation lower beds at locality 4: length 0.54 mm., height 0.34 mm.

Types.—All types are from the Yazoo formation lower beds at locality 4.

Occurrence.—In the Moodys Branch formation upper marl member: rare at locality 11; common at localities 10 and 17. In the Yazoo formation lower beds (facies): common to abundant at localities 1, 2, 3, 4 and 5; abundant at locality 6; common at locality 7; common to abundant at locality 11; common at localities 13 and 16. In the Yazoo formation upper beds (facies): rare to abundant at locality 9; rare to common at locality 14; rare at locality 15. In the North Twistwood Creek clay member: rare to common at locality 20; common at locality 22. In the Cocoa sand member: rare at locality 26; common at locality 31. In the Pachuta marl member: rare at localities 20 and 26.

BUNTONIA WARNERI (Howe and Pyeatt) 1935

Pl. 20, figs. 9, 10

Cythereis (?) israelskyi var. warneri Howe and Pyeatt in Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 35, pl. 3, fig. 8.

Diagnosis.—Carapace is subpyriform in lateral view. Surface of the valves is smooth and unsculptured.

Brief description.—Carapace is subpyriform in lateral view. Valves are inflated postmedially. Valve surface is smooth throughout. Muscle scar is typical for the genus. Hingement is holamphidont. Males are more elongate than females.

Dimensions.—Plesiotype no. 6107, a male right valve from the North Twistwood Creek clay member at locality 30: length 0.56 mm., height 0.29 mm.

Types.—All types are from the North Twistwood Creek clay member at locality 30.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 10; very rare at localities 12 and 24. In the upper marl member: rare at localities 10 and 17. In the Yazoo formation lower beds (facies) : rare at localities 1, 2, 4, 5, 6 and 11. In the Yazoo formation upper beds (facies) : rare at localities 9, 15 and 18. In the North Twistwood Creek clay member: rare to common at locality 20; rare at locality 22; common to abundant at locality 23; common at localities 25 and 28; abundant at localities 30 and 31. In the Cocoa sand member: common at locality 26; rare at locality 31. In the Pachuta marl member: rare to common at localities 22 and 26; rare at locality 29. In the Shubuta clay member: rare at locality 26.

BUNTONIA LEVINSONI n. sp.

Pl. 20, figs. 11-14

Buntonia n. sp. 1, Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 12, figs. 1, 4.

Diagnosis.—Surface of the valves is covered by a series of strong longitudinal ribs. Some of the ribs are branched, and in some specimens, there are a few transverse, connective riblets between the longitudinal ribs. On many specimens, especially

the left valves, the anterior marginal zones may be smooth with the remainder of the surface ribbed. There is a small round sulcus just above and slightly anterior to the center of the valve.

Description.—Carapace is small, subpyriform in lateral view. Dorsal margin is straight with a steep slope to the narrow posterior; ventral margin is straight to slightly sinuate. Anterior margin is broadly and evenly rounded, compressed, and has a wide rim. Posterior margin is slightly upturned at the posterodorsal part. Left valve overlaps the right valve at the anterior cardinal angle. Greatest height is at the anterior cardinal angle; greatest thickness postmedially. Surface of the valves is covered by a series of strong longitudinal ribs. Some of the ribs are branched, and in some specimens, there are a few transverse, connective riblets between the longitudinal ribs. On many specimens, especially the left valves, the anterior marginal zones may be smooth with the remainder of the surface ribbed. There is a small, round sulcus just above and slightly anterior to the center of the valve.

On the inside, the valves are moderately deep with broad marginal areas. Radial pore canals are numerous, closely spaced, and occur singly or paired. The line of concrescence coincides with the inner margin throughout. Muscle scar pattern consists of four small elongate adductors in a vertical row with a small V-shaped antennal scar, and another scar below it, anterior to them. Hingement is holamphidont with the hinge bar of the left valve and groove of the right valve being slightly crenulate. Males are more elongate than females.

Dimensions.—Holotype no. 6109, a female right valve from the Shubuta clay member at locality 26: length 0.58 mm., height 0.30 mm.

Types.—All types are from the Shubuta clay member at locality 26.

Comparisons.—This species differs from *B. shubutaensis* Howe in the nature of the rib ornamentation on the anterior and posterior regions of the carapace.

Etymology.—This species is named in honor of Dr. Stuart Levinson, Esso Production Research Company, Houston, Texas.

Occurrence.—In the Yazoo formation lower beds (facies): very rare at locality 11. In the North Twistwood Creek clay member: rare at localities 20 and 28. In the Pachuta marl member: rare at locality 22. In the Shubuta clay member: common at locality 21; common to abundant at locality 26; abundant at locality 27; rare at locality 29.

BUNTONIA SMITHI n. sp.

Pl. 20, figs. 15-17

Diagnosis.—Carapace is large for the genus. Surface of the valves is ornamented by a delicate pattern of reticles on the inflated portion and the remainder is smooth. There is a small round sulcus just anterior to the center.

Description.—Carapace is large for the genus, subpyriform in lateral view. Dorsal margin is straight and slopes steeply to the posterior; ventral margin is straight to slightly convex. Anterior margin is broadly and evenly rounded with a wide rim. Posterior margin is narrow, slightly upturned in the posterodorsal part. Greatest height is at the anterior cardinal angle; greatest thickness occurs postmedially. Surface of the valves is smooth except for a delicate pattern of reticles on the inflated portion. There is a small round sulcus slightly anterior to the center of the valves.

On the inside, the valves are moderately deep with broad, depressed marginal areas. Radial pore canals are numerous, closely spaced, and occur singly or paired. The line of concrescence coincides with the inner margin throughout. Muscle scar pattern is not determined with certainty but appears to consist of a row of four small oval-shaped adductors with a cluster of two or three small scars anterior to them. Hingement is holamphidont. The hinge bar of the left valve and the groove of the right valve are slightly crenulate. Males are more elongate and not as high in the anterior region as females.

Dimensions.—Holotype no. 6114, a female left valve from the Shubuta clay member at locality 26: length 0.67 mm., height 0.39 mm.

Types.—All types are from the Shubuta clay member at locality 26.

Comparisons.—This species is similar to *Pyricythereis huneri* Howe and Law, 1936, but differs in outline of the carapace; also the inflated posterior region is reticulated on *B. smithi* but is smooth on *P. huneri.*

Etymology: This species is named in honor of Mr. Harry R. Smith, Geologist, Humble Oil and Refining Company, New Orleans, Louisiana.

Occurrence.—In the Moodys Branch formation greensand member: very rare at locality 12. In the upper marl member: very rare at localities 11 and 22. In the Yazoo formation lower beds (facies): rare at localities 4 and 11. In the Yazoo formation upper beds (facies): rare to common at locality 9; rare at locality 14. In the North Twistwood Creek clay member: very rare at localities 20, 22 and 28. In the Shubuta clay member: common at locality 26.

Genus HAZELINA Moos, 1966

HAZELINA COULEYCREEKENSIS (Gooch) 1939

Pl. 21, figs. 1-5

Cythereis couleycreekensis Gooch, 1939, Jour. Paleo., vol. 13, no. 6, p. 584, pl. 67, figs. 1-3, 8.

Cythereis (?) couleycreekensis Gooch in Howe, 1963, La. Dept. Cons. Geol. Bull. 40, p. 40, pl. 4, figs. 13, 14.

Isocythereis couleycreekensis (Gooch) in Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 13, fig. 7.

Diagnosis.—Valve surfaces are covered by a network of web-like polygonal reticles; sculpturing consists of longitudinally extending dorsal and median ridges which join near the posterior cardinal angle; another ridge, subparallel to the ventral margin, extends from the anteroventral to the posteroventral zone.

Brief description.—Carapace is elongate, subrectangular in lateral view. Dorsal and ventral margins are straight and converge slightly toward the posterior. Valve surface is covered with a web-like network of polygonal reticles; surface sculpturing consists of longitudinally extending dorsal and median ridges which join near the posterior cardinal angle; another ridge, subparallel to the ventral margin, extends from the anteroventral to the

posteroventral zone. Muscle scar consists of four small oval-shaped adductors aligned vertically on the posterior edge of the muscle scar depression with two small scars within the depression. Hingement is weakly hemiamphidont. Males are more elongate than females.

Dimensions.—Plesiotype no. 6122, a female carapace from the Shubuta clay member at locality 27: length 0.71 mm., height 0.39 mm., thickness 0.33 mm.

Types.—All types are from the Shubuta clay member at locality 27.

Comparisons.—This species is similar to *Trachyleberidea aranea* Jones and Sherborn as refigured by Keij, 1957, but differs in being slightly more angular in outline and the dorsal ridge is shorter. *T. aranea* also has an additional small ridge which extends from the subcentral tubercle to the anterior margin which is not clearly evident in *H. couleycreekensis* (Gooch).

Occurrence.—In the North Twistwood Creek clay member: rare at locality 20. In the Pachuta marl member: common at locality 20; rare to common at locality 22; common to abundant at localities 26 and 29. In the Shubuta clay member: rare at localities 26, 27 and 29.

Genus HERMANITES Puri, 1955

HERMANITES COLLEI (Gooch) 1939

Pl. 21, figs. 6-9

Cythereis collei Gooch, 1939, Jour. Paleo., vol. 13, no. 6, p. 585, pl. 67, fig. 9; Bold, 1946, *Contribution to the Study of Ostracda*, Utrecht University, J. H. DeBussy, Amsterdam, p. 94, pl. 11, fig. 4; Bold, 1950, Jour. Paleo., vol. 24, no. 2, p. 178, pl. 30, figs. 30-32.

Hermanites collei (Gooch) in Bold, 1957, Micropaleontology, vol. 3, no. 1, pp. 9, 10, pl. 3, figs. 6 a-b.

Diagnosis.—Carapace is subrectangular in lateral view. Surface of the valves is sculptured by strong dorsal and ventral ridges which sweep up and back posteriorly each terminating with a blunt projection in the posterior third of the valves. There is an obliquely transverse ridge that connects the dorsal and

ventral ridges in the posteromedian zone. Three small sculptured ridges extend from the subcentral tubercle to a point near the anterior margin.

Brief description.—Carapace is subrectangular in lateral view. There is a "hinge ear" at the anterior cardinal angle. Surface sculpturing consists of strong dorsal and ventral ridges which sweep up and back posteriorly and each terminates with a short blunt projection in the posterior third of the valves. The posterior ends of the dorsal and ventral ridges are connected by a transverse ridge that extends obliquely across the posteromedian zone. Three small subparallel ridges extend from a strong subcentral tubercle to a point near the anterior margin. A small node-like projection lies just behind the subcentral tubercle. Commonly there are large foraminae which lie adjacent to and parallel to some of the ridges and the anterior margin. Muscle scar consists of a vertical row of four oval-shaped adductors on the posterior edge of the muscle depression with two small scars anterior to them within the depression. Hingement is holamphidont. Males are more elongate than females.

Dimensions.—Plesiotype no. 6128, a female left valve from the Moodys Branch greensand at locality 24: length 0.60 mm., height 0.33 mm.

Types.—All types are from the Moodys Branch greensand at locality 24.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 10; rare to common at locality 12; common at locality 20; rare at locality 22; rare to common at locality 24. In the upper marl member: common at locality 11. In Yazoo formation upper beds (facies): very rare at locality 18. In the North Twistwood Creek clay member: rare to common at locality 20; rare at localities 23, 28 and 30. In the Cocoa sand member: rare at localities 26 and 31. In the Pachuta marl member: rare at localities 26 and 29.

HERMANITES DOHMI (Howe and Chambers) 1935

Pl. 21, figs. 10-13

Cythereis hysonensis var. dohmi Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 32, pl. 1, fig. 9; Monsour, 1937, AAPG Bull., vol. 21, no. 1, p. 90; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 107, pl. 11, fig. 11.

Jugocythereis tricarinata Puri, 1957, Fla. Geol. Surv. Bull. 38, p. 201, pl. 12, figs. 1-10.

Hermanites (?) dohmi (Howe and Chambers) in Krutak, 1961, Jour. Paleo., vol. 35, no. 4, pp. 786, 787, pl. 93, fig. 14.

"Cythereis" dohmi Howe and Chambers in Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 14, fig. 1.

Diagnosis.—Carapace is subrectangular in lateral view. Surface is smooth but sculptured by strong, short dorsal and ventral ridges which sweep up and back posteriorly and each terminates with a strong projection in the posterior third of the valve. The dorsal and ventral ridges are connected across the posteromedian zone by an obliquely extending transverse ridge. There are numerous, randomly distributed normal pore canals visible on the valve surfaces.

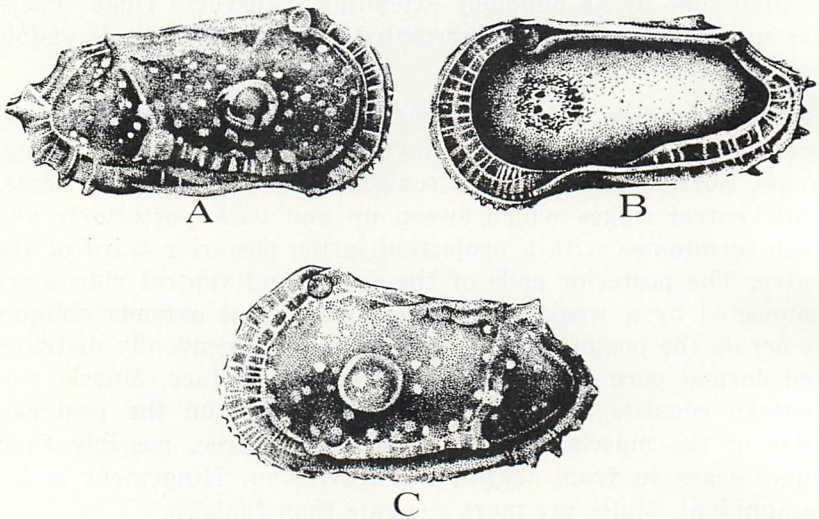
Brief description.—Carapace is elongate, subrectangular in lateral view. There is a small "hinge ear" at the anterior cardinal angle. Surface is smooth but sculptured by strong, short dorsal and ventral ridges which sweep up and back posteriorly and each terminates with a projection in the posterior third of the valve. The posterior ends of the dorsal and ventral ridges are connected by a weaker transverse ridge that extends obliquely across the posteromedian zone. Numerous randomly distributed normal pore canals are visible on the surface. Muscle scar pattern consists of four elongate adductors on the posterior edge of the muscle scar depression with three, possibly four, small scars in front within the depression. Hingement is holamphidont. Males are more elongate than females.

Dimensions.—Plesiotype no. 6131, a female right valve from the Shubuta clay member at locality 26: length 0.61 mm., height 0.33 mm.

Types.—Plesiotype nos. 6131, 6135 and 6136 are from the Shubuta clay member at locality 26; plesiotype nos. 6132-6134 are from the Moodys Branch formation at locality 12.

Occurrence.—In the Moodys Branch formation greensand member: common at locality 10; rare at localities 12 and 20; common at localities 22 and 24. In the upper marl member: abundant at localities 10, 11, 17 and 22; rare to common at locality 24. In the Yazoo formation lower beds (facies): common to abundant at localities 1 and 4; common at localities 5, 6 and 7;

rare to abundant at locality 11; common at localities 16 and 17. In the Yazoo formation upper beds (facies): rare at locality 18. In the North Twistwood Creek clay member: rare to common at localities 20 and 22; common to abundant at locality 23; rare to common at locality 28; rare at locality 30; common at locality 31. In the Cocoa sand member: rare at localities 26 and 31. In the Pachuta marl member: common at locality 20; rare to common at locality 22; common to abundant at localities 26 and 29. In the Shubuta clay member: common to abundant at locality 26; abundant at locality 27; abundant at locality 29.



Figrue 19.—**Hermanites dohmi** (Howe and Chambers)

A. External features of male right valve.

B. Internal features of male right valve.
Muscle scar pattern is generalized for the species and not necescesarily the pattern of a particular specimen.

C. External features of female valve.

HERMANITES HYSONENSIS

(Howe and Chambers) 1935

Pl. 21, figs. 14-17

Cythereis hysonensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 31, 32, pl. 1, fig. 8; pl. 6, figs. 23, 24; Garrett, 1936, Jour. Paleo.,

vol. 10, p. 786; Monsour, 1937 AAPG Bull., vol. 21, p. 89; Vernon, 1942, Fla. Geol. Surv. Bull. 21, p. 43; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125.

Cythereis cf hysonensis Howe and Chambers in Swain, 1948, Md. Bd. of Nat. Res., pp. 201-202, pl. 13, fig. 10.

Hermanites (?) hysonensis (Howe and Chambers) in Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 786, pl. 92, fig. 7.

"Cythereis" hysonensis Howe and Chambers in Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 14, figs. 2, 3.

Diagnosis.—Surface of the valves is coarsely reticulate. Sculpturing consists of a weak dorsal ridge and a stronger ventral ridge each terminating in the posterior third of the valve. An irregular transverse ridge extends across the posteromedian zone and connects the dorsal and ventral ridges. Also, a weak ridge may extend obliquely from the posterior terminus of the dorsal ridge to the subcentral tubercle.

Brief description.—Carapace is elongate, subrectangular in lateral view. Surface of the valves is coarsely reticulate with numerous normal pore canals. Sculpturing consists of a weak dorsal ridge and a stronger ventral ridge each terminating in the posterior third of the valve. The posterior ends of the dorsal and ventral ridges are connected by an irregular transverse ridge which extends across the posteromedian zone. In some specimens a weak ridge extends obliquely from the posterior terminus of the dorsal ridge to the subcentral tubercle. Muscle scar consists of a vertical row of four small oval-shaped adductors on the posterior edge of the muscle scar depression with one scar anterior to them within the depression. Hingement is holamphidont. Males are more elongate than females.

Dimensions.—Plesiotype no. 6137, a male carapace from the North Twistwood Creek clay member at locality 25: length 0.70 mm., height 0.33 mm.

Types.—Plesiotype nos. 6138-6141 are from the Yazoo formation lower beds at locality 16.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 11; rare to common at locality 12; rare to abundant at locality 24. In the upper marl member: rare at locality 11; abundant at localities 17, 22 and 24. In the Yazoo formation lower beds (facies): rare to common at locality 2; rare at locality 4; rare to abundant at locality 11; common at lo-

cality 16; common to abundant at locality 17. In the North Twistwood Creek clay member: common at locality 20; abundant at localities 22 and 25; common at locality 28; rare at locality 30; abundant at locality 31. In the Cocoa sand member: rare at locality 26; rare to common at locality 31. In the Pachuta marl member: rare to common at localities 22 and 26; rare at locality 29.

HERMANITES MELLENI n. sp.

Pl. 22, figs. 1-6

Diagnosis.—Surface of the valves is coarsely reticulate with a few round pore canals visible near the margins. Surface sculpturing consists of weakly developed dorsal and ventral ridges which terminate in the posterior third of the valve. There is a weak transverse ridge across the posteromedian zone which connects the dorsal and ventral ridges.

Description.—Carapace is elongate, subrectangular in lateral view. Dorsal margin is straight with a small "hinge ear" at the anterior cardinal angle; ventral margin is slightly sinuate. Anterior margin is broadly rounded, denticulate with a strong rounded rim. Posterior end is somewhat compressed with the margin slightly angulated at midposterior; straight in the dorsal part, slightly convex in the ventral part with three or four blunt spines. Surface of the valves is coarsely reticulate with a few round pore canals visible near the margins. Surface sculpturing consists of weakly developed dorsal and ventral ridges which terminate in the posterior third of the valves. The posterior ends of the dorsal and ventral ridges are connected by a faint transverse ridge which extends across the posteromedian zone. Subcentral tubercle is present.

On the inside, the valves are shallow with broad marginal areas. Radial pore canals are numerous, closely spaced, and occur singly or in bundles of two or more. The line of concrescence coincides with the inner margin at the anterior. Muscle scar pattern consists of four small, elongate-ovate adductors on the posterior edge of the muscle scar depression with two scars slightly anterior to them within the depression. Hingement is holamphidont. Dimorphism is weak. Some forms are slightly more elongate than others and may be the males.

Dimensions.—Holotype no. 6144, a female left valve from the Moodys Branch greensand at locality 24: length 0.60 mm., height 0.33 mm.

Types.—All types are from the Moodys Branch greensand at locality 24.

Comparisons.—The surface sculpture of this species is not as strongly developed as that of the other species assigned to this genus. It is easily distinguished from *H. hysonensis* by the weaker and more subdued dorsal and ventral surface sculpture and also has a less prominent subcentral tubercle than the latter. In some respects it resembles *Murrayina martini* Puri, 1953, but differs in muscle scar pattern, surface sculpture, and the midposterior is more sharply angled than in *M. martini.*

Etymology.—This species is named in honor of Mr. Frederic F. Mellen, Geologist, Jackson, Mississippi.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 10; common at localities 11 and 12; rare to common at locality 20; common to abundant at locality 22; rare to common at locality 24. In the Cocoa sand member; rare at locality 31. In the Pachuta marl member: very rare at localities 26 and 29.

HERMANITES MOODYSBRANCHENSIS n. sp.

Pl. 22, figs. 7-11

Diagnosis.—Surface of the valves is covered with a web-like network of polygonal reticles. Sculpturing consists of a weak dorsal ridge and a strong ventral ridge which are subparallel to their respective margins. Both ridges die out in the posterior third of the valves.

Description.—Carapace is elongate-subquadrate in lateral view. Dorsal margin is straight and slightly flattened near the anterior cardinal angle. Ventral margin is straight. Both margins converge slightly toward the posterior. Anterior margin is broadly rounded with numerous minute denticles below a raised marginal rim. Posterior margin is angulated at midposterior; concave in the dorsal half, convex in the ventral half with a tuft of five or six blunt spines. Surface of the valves is reticulate wit

the polygonal reticles forming a coarse web-like network. Surface sculpturing consists of a well-developed longitudinal ventral ridge and a less prominent dorsal ridge which are subparallel to their respective margins. Both ridges die out in the posterior third of the valves.

On the inside, the valves are shallow with broad marginal areas. Radial pore canals are numerous, sometimes branched, and occur singly or in pairs. Muscle scar consists of four, elongate, oval-shaped adductors on the posterior edge of a subcentral muscle depression with two small scars within the depression. Hingement is holamphidont with the median groove of the right valve and the bar of the left valve slightly crenulate. Dimorphism is not determined.

Dimensions.—Holotype no. 6148, a right valve from the Moodys Branch greensand at locality 24: length 0.70 mm., height 0.37 mm.

Types.—All types are from the Moodys Branch greensand at locality 24.

Comparisons.—This species closely resembles *Hermanites reticulata* Puri but is slightly more elongate and also differs slightly in outline of the valves in lateral view.

Etymology.—This species is named for the Moodys Branch in Jackson, Mississippi, which is the small creek for which the Moodys Branch formation was named.

Occurrence.—In the Moodys Branch formation greensand member: rare at localities 12 and 24.

Genus TROPIDOCYTHERE n. gen.

Type Species Tropidocythere carinata n. sp.

Pl. 22, figs. 12-18

Description of genus.—Carapace is ovate-subquadrate in lateral view. Surface sculpturing consists essentially of a strongly developed ventral ridge and somewhat weaker dorsal and median ridges, the latter two being joined near the posterior cardinal angle. Small oblique transverse connective ridges may also be present. The muscle scar pattern consists of an adductor group

arranged in a vertical tier of three pairs of elongate scars with a single elongate scar at the bottom of the tier. These are located on the posterior side of the muscle scar depression. Two small round scars, directed obliquely forward and downward, are in front of the top pair of adductors and are within the depression. Fusion may cause some variability in the pattern. Eye tubercle is prominent. Hingement is holamphidont. Dimorphism is discernble but not marked. Males are slightly more elongate than females.

Dimensions.—Adult valves range: length 0.57 mm. to 0.60 mm, height 0.29 mm. to 0.36 mm.

Comparisons.—This genus resembles *Hemicythere* Sars, 1925, in outline of carapace and hingement but differs considerably in surface sculpturing. It also resembles *Trachyleberidea* Bowen, 1953, in surface sculpturing but differs considerably in carapace outline and hingement. The subcentral tubercle and surface sculpturing suggest that this genus is a Trachyleberid form. It is suggested that *Cythereis rukasi* Gooch, 1939, belongs to this genus. (See Jour. Paleo., vol. 13, no. 6, p. 586, pl. 67, fig. 20, 1939.)

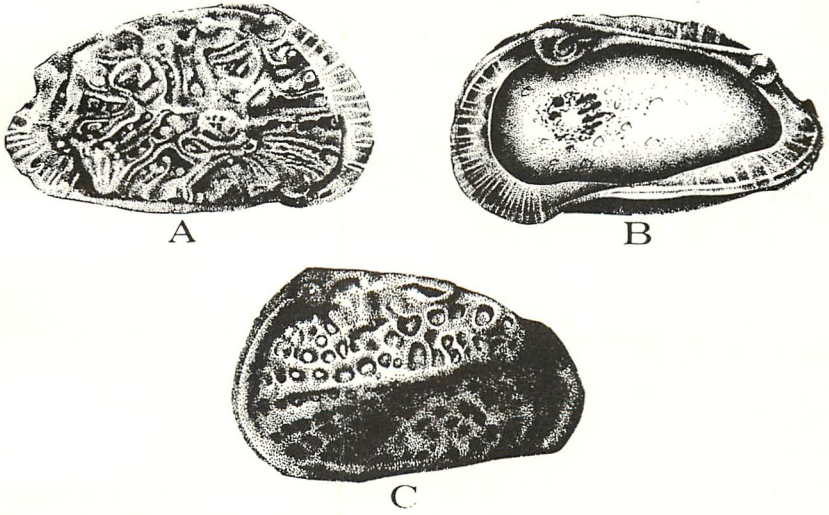


Figure 20.—**Tropidocythere carinata** n. gen. n. sp.

A. Right valve of paratype no. 6155.

B. Inside valve view of same specimen. Muscle scar pattern represents a generalization for the species and not necessarily that of a particular specimen.

C. Left valve view of holotype no. 6157 showing external features

TROPIDOCYTHERE CARINATA n. sp.

Pl. 22, figs. 12-18

Diagnosis.—Carapace is ovate in lateral view. Surface sculpturing consists of a short, sinuous dorsal ridge which begins below the middle of the dorsal margin and extends back to a point near the posterodorsal angle; then it loops back across the valve to the subcentral tubercle. A strong ventral ridge parallels the venter. Small, oblique transverse ridges intersect the ventral and median ridges in most specimens. Surface is reticulate with numerous normal pore canals visible.

Description.—Carapace is ovate in lateral view. Dorsal margin is straight to slightly arched; ventral margin is straight. Both margins gently converge posteriorly. Anterior margin is broadly rounded, denticulate, and has a raised rim. Posterior is compressed, obtuse; posterior margin is slightly concave in the dorsal part, convex in the ventral part. Left valve overlaps the right valve at the anterior cardinal angle. Greatest height is at the anterior cardinal angle; greatest thickness is slightly postmedian. Surface is reticulate and sculptured with a short, sinuous dorsal ridge which begins below the middle of the dorsal margin and extends back to a point near the posterodorsal angle; then it loops back across the valve to the subcentral tubercle. A strong ventral ridge parallels the venter. Small, oblique transverse ridges intersect the ventral and median ridges in most specimens. Normal pore canals are numerous. Eye tubercle is round, prominent.

On the inside, the valves are shallow with broad marginal areas. Radial pore canals are numerous, closely spaced, and occur singly or paired. The line of concrescence coincides with the inner margin throughout. Muscle scar pattern consists of an adductor group arranged in a vertical tier of three elongate pairs of split adductors and a single elongate adductor at the bottom on the posterior side of the muscle depression. Two small round scars in a line, directed obliquely forward and downward, are anterior to the top pair of adductors and are within the depression. Hingement is holamphidont. Males are slightly more elongate than females.

Dimensions.—Holotype no. 6157, a female left valve from the Moodys Branch greensand at locality 24: length 0.57 mm., height 0.31 mm.

Types.—All types are from the Moodys Branch greensand at locality 24.

Etymology.—Carinata means "keeled" which is suggestive of the dorsal and ventral keel-like ridges on this species.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 10; rare to common at locality 12; rare at locality 20; common at localities 22 and 24. In the upper marl member: rare at locality 11; common at locality 22; rare to common at locality 24. In the North Twistwood Creek clay member: rare at localities 22 and 23. In the Cocoa sand member: rare at localities 26 and 31. In the Pachuta marl member: very rare at locality 22.

Genus OCCULTOCYTHEREIS Howe, 1951

OCCULTOCYTHEREIS BROUSSARDI

(Howe and Chambers) 1935

Pl. 23, figs. 1-5

Cythereis broussardi Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 24, 25, pl. 4, fig. 6; Monsour, 1937, AAPG Bull., vol. 21, pp. 89, 94; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 106, pl. 11, fig. 7.

Occultocythereis broussardi (Howe and Chambers) in Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 12, fig. 2.

Diagnosis.—Surface sculpturing consists of a dorsal ridge that extends from near the eye tubercle to a point near the posterior cardinal angle where it turns back sharply and forms a blunt projection. A short ridge extends subparallel to the venter across the midventral zone. There is a low sinus in the posteromedian zone.

Brief description.—Carapace is small, subovate in lateral view. Anterior margin is broadly rounded with a prominent rim which is denticulate in the lower two-thirds. Surface is translucent to glassy with some undulations. Surface sculpturing consists of a dorsal ridge which extends from just behind the eye tubercle

to near the posterior cardinal angle where it turns back sharply and forms a blunt projection. A short ridge near the venter extends across the midventral zone and terminates in the posteromedian zone near the dorsal ridge projection. There is a low sinus in the posteromedian zone. Muscle scar consists of four small adductors in a vertical row with two scars anterior to them. Hingement is holamphidont. Males are more elongate than females.

Dimensions.—Plesiotype no. 6164, a female carapace from the Pachuta marl member at locality 29: length 0.54 mm., height 0.29 mm.

Types.—Plesiotype nos. 6161 - 6163 are from the Moodys Branch greensand at locality 10.

Remarks.—The left valve on cotype slide no. 814, Henry V. Howe Collection, Louisiana State University, is designated as the lectotype of this species.

Occurrence.—In the Moodys Branch formation greensand member: rare at localities 10, 11, 12, 20 and 22; rare to common at locality 24. In the upper marl member: rare at locality 10; rare to common at locality 11; rare at localities 17, 22 and 24. In the Yazoo formation lower beds (facies) : rare at localities 1 and 11. In the North Twistwood Creek clay member: very rare at locality 31. In the Pachuta marl member: rare at localities 22, 26 and 29. In the Shubuta clay member: rare at locality 26.

OCCULTOCYTHEREIS sp.

Pl. 23, fig. 6

Remarks.—Only one valve of this species was found in the Pachuta marl member at locality 29. It is similar to *O. delumbata* Howe 1951, but differs slightly in outline. It is figured for reference.

Dimensions.—Figured specimen no. 6165, a left valve from the Pachuta marl member at locality 29: length 0.53 mm., height 0.26 mm.

Genus MURRAYINA Puri, 1953

MURRAYINA sp.

Pl. 23, fig. 7

Remarks.—One valve of this species was found in the Shubuta clay member at locality 26, and one valve was found in the Yazoo formation upper beds at locality 14. It is figured for reference.

Dimensions.—Figured specimen no. 6166, a right valve from the Shubuta clay member at locality 26: length 0.60 mm., height 0.33 mm.

Genus "Archicythereis" Howe, 1936

"ARCHICYTHEREIS" YAZOOENSIS

(Howe and Chambers) 1935

Pl. 23, figs. 8, 9

Cythereis yazooensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 38, 39, pl. 1, fig. 6; pl. 4, figs. 29, 30; Garrett, 1936, Jour. Paleo., vol. 10, p. 786; Monsour, AAPG Bull., vol. 21 pp. 90, 96; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 108, pl. 11, fig. 17.

Archicythereis yazooensis (Howe and Chambers) in Howe and Law, 1936, La. Dept. Cons. Bull. 7, p. 57; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 124; *Treatise on Invertebrate Paleontology (Q) Arthropoda,* 1961, p. Q336.

"Archicythereis" yazooensis (Howe and Chambers) in Krutak, 1961, Jour. Paleo., vol. 35, no. 4, p. 783, pl. 93, fig. 17.

Diagnosis.—Carapace is thin, delicate, smooth and pellucid. Anterior margin is broadly rounded and fringed with several flat T-shaped spines. Valves are alate. Hinge of the left valve is without teeth.

Brief description.—Carapace is delicate, transparent to translucent, and elongate-subpyriform in outline. Dorsal and ventral margins are straight and converge toward the posterior. Anterior margin is broadly rounded with several flat T-shaped spines fringing the border. A small ala, tipped with a spine, protrudes from the centro-ventral region of the valves.

On the inside, the valves are shallow with very narrow marginal areas. Radial pore canals are few and widely spaced. The line of concrescence coincides with the inner margin. Muscle scar consists of a vertical row of four adductors with a heart-shaped antennal scar anterior to them. Hinge of the left valve is without teeth. Dimorphism is not determined.

Dimensions.—Plesiotype no. 6167, a left valve from the Shubuta clay member at locality 26: length 0.77 mm., height 0.44 mm.

Types.—All types are from the Shubuta clay member at locality 26.

Remarks.—The left valve on cotype slide no. 808, Henry V. Howe Collection, Louisiana State University, is designated as the lectotype of this species.

This form undoubtedly represents a young molt stage of one or more of the Trachyleberid species. It is difficult to assign it to a particular species, however, because there are several species of *Trachyleberidae* which have young molts identical to *"Archicythereis"*.

Occurrence.—Common, rare to common or common to abundant in all stratigraphic levels and found at essentially all sample localities of the Jackson group in Mississippi.

Family XESTOLEBERIDAE Sars, 1928

Genus XESTOLEBERIS Sars, 1866

XESTOLEBERIS SARSI Howe and Chambers 1935

Pl. 23, figs. 10-13

Xestoleberis sarsi Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 48, pl. 3, fig. 9; pl. 4, fig. 10; pl. 6, fig. 16; Monsour, 1937, AAPG Bull., vol. 21, no. 1, p. 89; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125.

Diagnosis.—Carapace is smooth, tumid and egg-shaped in lateral view. Males are much smaller and less tumid than females.

Brief description.—Carapace is smooth, tumid, egg-shaped in lateral view. Dorsal margin is strongly arched and tapers to a narrowly rounded anterior end. Posterior is truncate. Greatest

height and thickness occurs medially. Hingement is merodont. Males are considerably smaller, more elongate and less tumid than the females.

Dimensions.—Plesiotype no. 6170, a female carapace from the Moodys Branch greensand at locality 12: length 0.60 mm., height 0.41 mm.

Types.—Plesiotype no. 6171, a male carapace from the North Twistwood Creek clay member at locality 28.

Remarks.—The female left valve on cotype slide no. 833, Henry V. Howe Collection, Louisiana State University, is designated as the lectotype of this species.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 10; rare to common at locality 12; rare at locality 22; rare to common at locality 24. In the upper marl member: common at locality 22; rare to common at locality 24. In the North Twistwood Creek clay member: common at locality 22; common to abundant at locality 23; common at locality 25; common to abundant at locality 28; comman at localities 30 and 31. In the Cocoa sand member: rare at locality 26. In the Pachuta marl member: rare to common at localities 26 and 29. In the Shubuta clay member: very rare at locality 26.

Family INCERTAE SEDIS

Genus ABSONOCYTHEROPTERON Puri, 1957

ABSONOCYTHEROPTERON CARINATA Puri 1957

Pl. 23, figs. 14-16

Absonocytheropteron carinata Puri, 1957, Fla. Geol. Surv. Bull. 38, pp. 204, 205, pl. 14, figs. 9-12; pl. 15, figs. 9-12; *Treatise on Invertebrate Paleontology (Q) Arthropoda*, 1961, p. Q344, fig. 270, 1 a-d.

Diagnosis.—Carapace is alate, subpyriform in lateral view. Surface is ornamented with two sets of ridges. One set of five ridges, convex anteriorly, is located in the anteroventral zone and another set of seven ridges, concave posteriorly, covers the posterodorsal zone.

Brief description.—Carapace is alate, subpyriform in lateral view. Surface ornamentation consists of two sets of concentric ridges and furrows. There is an anteroventral set of five ridges, convex anteriorly, and a posterodorsal set of seven ridges concave toward the posterior cardinal angle. There are six or seven large foraminae along the rim of the ala. Hingement is modified holamphidont with connecting groove in the right valve slightly crenulate and the posterior tooth of the right valve is elongate and slightly lobed. Dimorphism is not determined.

Dimensions.—Plesiotype no. 6174, a complete carapace from the Moodys Branch greensand at locality 24: length 0.71 mm., height 0.40 mm., thickness 0.40 mm.

Types.—All types are from the Moodys Branch greensand at locality 24.

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 10; comman at locality 11; rare to abundant at locality 12; common at locality 20; abundant at locality 22; common at locality 24. In the upper marl member: rare at locality 11; common at locality 22; rare at locality 24. In the Cocoa sand member: rare at localities 26 and 31.

ABSONOCYTHEROPTERON WATERVALLEYENSIS

Krutak 1961

Pl. 24, figs. 1-5

Absonocytheropteron watervalleyensis Krutak, 1961, Jour. Paleo., vol. 35, no. 4, pp. 785, 786, pl. 92. fig. 11.

Diagnosis.—Carapace is weakly alate, elongate-ovate in lateral view. Surface is smooth with a series of small longitudinal ridges aligned parallel to the ala along the ventral convex extremity and also along the flat bottom part of the valves.

Brief description.—Carapace is weakly alate, convex ventrally, elongate-ovate in lateral view. Surface is smooth with a series of small longitudinal ridges aligned parallel to the alae along the ventral convex extremity and also along the flat bottom part of the valves. Muscle scar pattern consists of a row of three oval-shaped adductors with one scar just above and another scar just

anterior to the middle of the adductor row. There is also another small cluster of two or three scars anterior to the main group. Hingement is holamphidont with the posterior tooth of the right valve somewhat dorsally recurved. Males are more elongate than females.

Dimensions.—Plesiotype no. 6177, a male carapace from the North Twistwood Creek clay member at locality 31: length 0.77 mm., height 0.39 mm.

Types.—Plesiotype nos. 6175 and 6176 are from the Cocoa sand member at locality 31; plesiotype nos. 6177-6179 are from the North Twistwood Creek clay member at locality 31.

Occurrence.—In the North Twistwood Creek clay member: common at locality 31. In the Cocoa sand member: rare at localities 26 and 31. In the Pachuta marl member: rare at locality 26. In the Shubuta clay member: very rare at locality 26.

Genus PSEUDOCYTHEROMORPHA Puri, 1957

PSEUDOCYTHEROMORPHA sp.

Pl. 24, fig. 6

Remarks.—One carapace of this species was found in the Cocoa sand member at locality 31. It slightly resembles *P. elongata* Puri, but the valves are smaller and the sulcus is less prominent. There are also no spines present on the anterior and posterior margins as in *P. elongata.* It is figured for reference.

Dimensions.—Figured specimen no. 6180, a complete carapace from the Cocoa sand member at locality 31: length 0.54 mm., height 0.23 mm.

Suborder PLATYCOPINA Sars, 1866

Family CYTHERELLIDAE Sars, 1866

Genus CYTHERELLA Jones, 1849

CYTHERELLA HANNAI Howe and Lea 1936

Pl. 24, figs. 7-9

Cytherella hannai Howe and Lea in Howe and Law, 1936, La. Dept. Cons. Geol. Bull. 7, p. 16, pl. 1, figs. 1-5.

Diagnosis.—The left valve has a thin carina around the anterior margin and the posteroventral part is produced into a projecting flange which overlaps the right valve in that region.

Brief description.—Carapace is elongate, smooth, with a thin carina around the anterior margin of the left valve. The posteroventral part of the left valve is produced into a projecting flange which overlaps the right valve in that region. Muscle scar consists of twelve to fourteen small elongate scars arranged in a pinnate pattern near the center of the valves. Hingement is adont.

Dimensions.—Plesiotype no. 6182, a left valve from the Shubuta clay member at locality 27: length 0.83 mm., height 0.44 mm.

Types.—Plesiotype nos. 6181 and 6182 are from the Shubuta clay member at locality 27; plesiotype nos. 6183 and 6184 are from the Shubuta clay member at locality 26.

Comparisons.—The cotypes of Howe and Lea, 1936, from the Red Bluff clay (Oligocene) show a slightly stronger development of the posteroventral flange of the left valve than do the Jackson specimens. In all other respects the specimens are the same.

Occurrence.—In the Pachuta marl member: abundant at locality 26; common to abundant at locality 29. In the Shubuta clay member: common at locality 26: abundant at localities 27 and 29.

CYTHERELLA SYLVERINICA Howe and Law 1936

Pl. 24, figs. 10, 11; Pl. 25, figs. 1-3

Cytherella sylverinica Howe and Law, 1936, La. Dept. Cons. Geol. Bull. 7, p. 18, pl. 1, figs. 12, 13.

Cytherella aff. C. sylverinica Howe and Law in Bold, 1958, Micropaleontology, vol. 4, no. 4, p. 396, pl. 1, figs. 1 a-b.

Diagnosis.—Carapace is smooth, subovate in lateral view. Dorsal margin is gently arched; ventral margin is straight.

Brief description.—Carapace is smooth, subovate in lateral view. Dorsal margin is gently arched; ventral margin is essentially straight. Anterior margin is broadly and evenly rounded; posterior margin is more narrowly rounded. The right valve over-

laps the left valve with the strongest overlap along the venter and the anterior half of the dorsum. Muscle scar consists of several elongate scars in a pinnate pattern near the center of the valve. Hingement is adont.

Dimensions.—Plesiotype no. 6185, a carapace from the Shubuta clay member at locality 26: length 0.84 mm., height 0.51 mm., thickness 0.39 mm.

Types.—All types are from the Shubuta clay member at locality 26.

Occurrence.—In the Yazoo formation upper beds (facies) : common at locality 9; rare at locality 19. In the Pachuta marl member: abundant at localities 20 and 22; common to abundant at localities 26 and 29. In the Shubuta clay member: common to abundant at locality 26; abundant at locality 27; rare at locality 29.

CYTHERELLA INSCULPTILLA n. sp.

Pl. 25, figs. 4-9

Diagnosis.—Dorsal margin is straight to slightly sinuate at middorsum; ventral margin is concave at midventer. Surface is smooth and glossy except for several rows of delicate wavy ridges which are best developed in the anterior half of the valve.

Description.—Carapace is elongate, subrectangular in lateral view. Dorsal margin is straight to slightly sinuate at mid-dorsum; posterodorsum is obtusely angled. Ventral margin is concave at midventer. Anterior margin is evenly rounded; posterior margin is truncate. In dorsal view the valves are wedge-shaped with the greatest thickness near the posterior. Right valve overlaps the left valve along the dorsal, ventral and anterior margins. Surface is glossy and ornamented with several rows of delicate wavy ridges which are best developed in the anterior half of the valves. A small subcircular sulcus is present slightly dorsad of center on each valve.

On the inside, the valves are shallow with the deepest part at the posterior. Muscle scar pattern consists of eight to ten small elongate scars pinnately arranged on a low round sinus just slightly dorsad of center of each valve. Hingement is adont. Dimorphism is not determined.

Dimensions.—Holotype no. 6189, a carapace from the Shubuta clay member at locality 26: length 0.74 mm., height 0.40 mm.

Types.—All types are from the Shubuta clay member at locality 26.

Comparisons.—This species resembles *Cytherella pustulosa* Keij, 1957, but differs in that the ornamentation of *C. pustulosa* consists of curved rows of elongate depressions forming knobs near the anterior margin whereas *C. insculptilla* n. sp. possesses only small delicate wavy ridges. In addition, the posterior of *C. pustulosa* is more oblique than that of *C. insculptilla* n. sp.

Etymology. — Insculptilla means "slightly sculptured" which describes the faint, wavy ridge ornamentation on the anterior part of the valve surface.

Occurrence.—In the Yazoo formation lower beds (facies): common at locality 16. In the Yazoo formation upper beds (facies): common at locality 14. In the Shubuta clay member: rare to common at locality 26; common at locality 27.

CYTHERELLA sp. Howe and Chambers 1935

Pl. 25, figs. 10, 11

Cytherella sp. Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, p. 6, pl. 4, figs. 17, 18; pl. 5, figs. 11, 12; Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 105, pl. 11, fig. 1; Bold, 1946, *Contribution to the Study of Ostracoda*, Utrecht University, J. H. DeBussy, Amsterdam, p. 60, pl. 2, fig. 4; Bold, 1950, Jour. Paleo., vol. 24, no. 1, p. 108.

Diagnosis.—Carapace is smooth. Ends are subequal. Dorsal and ventral margins are concave at their midpoints.

Brief description.—Carapace is elongate-ovate in lateral view. Dorsal margin is slightly concave at middorsum; ventral margin is slightly concave at midventer. Anterior and posterior margins are evenly rounded, subequal. Right valve overlaps left valve more prominently along the dorsal margin. Muscle scar is characteristic for the genus. Hingement is adont.

Dimensions.—Plesiotype no. 6192, a complete carapace from the North Twistwood Creek clay member at locality 23: length 0.66 mm., height 0.37 mm.

Occurrence.—In the Moodys Branch formation upper marl member: rare at localities 11 and 24. In the Yazoo formation upper beds (facies) : rare to common at locality 9. In the North Twistwood Creek clay member: common at locality 22; rare at locality 23; common at locality 25; common to abundant at locality 28; abundant at localities 30 and 31. In the Cocoa sand member: rare at locality 26. In the Pachuta marl member: rare at localities 26 and 29. In the Shubuta clay member: common at locality 29.

CYTHERELLA undetermined sp. A.

Pl. 25, figs. 12-14

Diagnosis.—Carapace is smooth, elongate-ovate in lateral view. The left valve is produced into a weakly projecting flange in the posteroventral part which overlaps the right valve in that region.

Brief description.—Carapace is smooth, elongate-ovate in lateral view. Anterior margin is broadly and evenly rounded; posterior margin is narrow and sharply rounded in the posterodorsal part. Dorsal and ventral margins are slightly convex and tend to converge toward the posterior. The posteroventral part of the valve is produced into a weakly projecting flange which overlaps the right valve in that region.

On the inside, the valves are relatively shallow with the deepest portion at the posterior end. Musculature and hingement are typical for the genus. Dimorphism is not determined.

Dimensions.—Figured specimen no. 6194, a carapace from the North Twistwood Creek clay member at locality 23: length 0.71 mm., height 0.46 mm., thickness 0.33 mm.

Types.—Figured specimen nos. 6193, 6194 and 6196 are from the North Twistwood Creek clay member at locality 23; specimen no. 6195 is from the Moodys Branch greensand at locality 10.

Comparisons.—This species is very similar to *Cytherella hannai* Howe and Lea but the specimens found in the North Twistwood Creek clay differ in having a smaller carapace; it is less elongate in outline and has a weaker posteroventral flange on the left

valve. The specimens of this species most easily differentiated from *C. hannai* occur in the North Twistwood Creek clay. At other horizons there seems to be closer intergrading or a closer similarity to *C. hannai* which makes identification difficult. This form may be a subspecies or variety of *C. hannai.*

Occurrence.—In the Moodys Branch formation greensand member: common at localities 10 and 11; common to abundant at locality 12; common at locality 20; rare at locality 22; rare to common at locality 24. In the upper marl member: common at locality 10; abundant at localities 11, 17 and 22; rare to common at locality 24. In the Yazoo formation lower beds (facies): common at locality 1; rare at localities 4, 6 and 11; common at locality 16; abundant at locality 17. In the Yazoo formation upper beds (facies): common at localities 9, 14, 15 and 18. In the North Twistwood Creek clay member: rare to abundant at localities 20 and 22; common to abundant at locality 23. In the Cocoa sand member: rare to localities 26 and 31. In the Pachuta marl member: rare at locality 22; common at locality 26; rare at locality 29. In the Shubuta clay member: abundant at locality 21; rare to common at locality 26; common at localities 27 and 29.

CYTHERELLA undetermined sp. B

Pl. 26, figs. 1-3

Diagnosis.—Carapace is smooth, elongate-ovate in lateral view. Both dorsal and ventral margins are arched forming a peak near the center of each margin.

Brief description.—Carapace is smooth, elongate-ovate in lateral view. Dorsal and ventral margins are arched forming a peak near the center of each margin with the dorsal peak the stronger. Anterior margin is evenly rounded; posterior margin is obliquely truncate between rounded posterodorsal and posteroventral margins. Right valve overlaps the left valve along the dorsal and ventral margins.

On the inside, the valves are shallow with two subcircular depressions at the posterior end. Musculature and hingement are typical for the genus. Males are thinner in dorsal view and not as thick at the posterior end as the females.

Dimensions.—Figured specimen no. 6197, a carapace from the Yazoo formation lower beds at locality 17: length 0.76 mm., height 0.47 mm.

Types.—All specimens are from the Yazoo formation lower beds at locality 17.

Comparisons.—This species resembles *C. sylverinica* Howe and Law but differs in that both dorsal and ventral margins of this species are more convex and the posterior margin is more oblique than in *C. sylverinica.* It also differs from *C. moremani* Alexander 1921, in that the dorsal slope of the latter is steeper and the ventral margin is more peaked in the center in *C.* undet. sp. B. than in *C. moremani.*

Occurrence.—In the Moodys Branch formation greensand member: rare at locality 10; common to abundant at locality 12; abundant at locality 22; common at locality 24. In tne upper marl member: rare at localities 10 and 11; abundant at locality 17. In the Yazoo formation lower beds (facies): common to abundant at locality 1; rare to common at localities 2 and 3; abundant at locality 4; common at locality 5; abundant at localities 7, 11 and 13; common at locality 16; abundant at locality 17. In the Yazoo formation upper beds (facies): rare to common at localities 9 and 14; common at locality 19. In the North Twistwood Creek clay member: Questionable occurrence. If it occurs at all, it is rare at locality 20. In the Pachuta marl member: common at locality 23; rare at locality 26. In the Shubuta clay member: common at locality 26.

Genus CYTHERELLOIDEA Alexander, 1929

CYTHERELLOIDEA COCOAENSIS Krutak 1961

Pl. 26, figs. 4-8

Cytherelloidea cocoaensis Krutak, 1961, Jour. Paleo., vol. 35, no. 4, pp. 773, 774, pl. 93, fig. 13; Deboo, 1965, Geol. Surv. Ala. Bull. 80, pl. 2, figs. 1, 2.

Diagnosis.—Female: A rounded medial rib loops around the subcentral sulcus and forms a deep U-shape with the concave portion of the U opening toward the posterodorsum. Male: Male valves are flatter and smaller than the female. A rounded medial

rib begins in the anteromedian zone and extends sinuously around the ventral part of the subcentral sulcus and intersects the peripheral rib at posterodorsum.

Brief description.—Female: Posterior edge is elevated. A raised, rounded submarginal rib borders the dorsal and ventral margins but extends around the anterior margin well within the peripheral edge. A high, rounded medial rib begins on the dorsum at a point just behind middorsum and slants downward and around a subcentral sulcus and then loops back for a short distance toward the posterodorsal zone, then curves over toward the posterior border and intersects the latter slightly dorsad of mid-posterior. Another rounded rib, below, parallels the venter from a point on the posteroventral edge to a point within the anteroventral zone. Muscle scar is typical for the genus. Hingement is adont. Male: Valves are essentially flat, smaller than the female, and the posterior margin is obliquely truncate. A rounded subperipheral rib extends around all margins. A rounded medial rib begins in the anteromedian zone and extends sinuously around the ventral part of the subcentral sulcus and intersects the subperipheral rib at posterodorsum. A longitudinal rib, near the venter, parallels the ventral margin from the posteroventral zone to the anteroventral zone. Muscle scar is typical for the genus. Hingement is adont.

Dimensions.—Plesiotype no. 6200, a female right valve from the Cocoa sand member at locality 31: length 0.61 mm., height 0.37 mm.

Types.—All types are from the Cocoa sand member at locality 31.

Occurrence.—In the Yazoo formation upper beds (facies): common at locality 9; abundant at locality 14; common at locality 15. In the North Twistwood Creek clay member: rare at localities 20, 25 and 31. In the Cocoa sand member: common at locality 26; rare to common at locality 31.

CYTHERELLOIDEA MONTGOMERYENSIS Howe 1934

Pl. 26, figs. 9-12

Cytherelloidea montgomeryensis Howe, 1934, Jour. Paleo., vol. 8, no. 1, pp. 31-32; Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 7, 8,

pl. 5, fig. 4; Garrett, 1936, Jour. Paleo., vol. 10, p. 786; Monsour, 1937, AAPG Bull., vol. 21, no. 1, pp. 89, 94; Sexton, 1951, Jour. Paleo., vol. 25. no. 6, pp. 808, 810, pl. 115, fig. 21; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125; Krutak, 1961, Jour. Paleo., vol. 35, no. 4, pp. 772, 773, pl. 93, figs. 7, 10; Pooser, 1965, Univ. Kans. Paleo. Contr. Art. 8, p. 29, pl. 1, figs. 1, 4, 5, 8-11.

Cytherelloidea danvillensis Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 6, 7, pl. 5, fig. 5; Wilbert, 1953, Ark. Res. and Dev. Comm., Div. Geol. Bull. 19, p. 125, pl. 1, fig. 17.

Cytherelloidea danvillensis var. Bergquist, 1942, Miss. Geol. Surv. Bull. 49, p. 105, pl. 11, fig. 2.

Diagnosis. — Female: A high rounded rib forms a U around the subcentral sulcus with a short longitudinal rib extending over to the posterior border. Male: Male valves are flat and smaller than the female. A rounded medial rib forms a wide U around the dorsomedian zone, and another rib, below the medial rib, parallels the venter.

Brief description. — Female: Posterior edge is elevated. A high rounded rib extends subperipherally along the dorsal, ventral and anterior margins. A rounded medial rib forms a U around the subcentral sulcus with a short, longitudinal branch rib extending over to the posterior border. A longitudinal rib, below, parallels the venter from the posteroventral border to the antero-ventral zone. Muscle scar is typical for the genus. Hingement is adont. Males: Valves are flat, smaller than the females with the posterior margin obliquely truncate. A rounded subperipheral rib extends around all margins. A rounded medial rib forms a wide U around the dorsomedian zone and another rib, below the medial rib, parallels the venter. Muscle scar is typical for the genus. Hingement is adont.

Dimensions. — Plesiotype no. 6523. a female right valve from the Moodys Branch upper marl member at locality 10: length 0.67 mm., height 0.40 mm.

Types. — All types are from the Moodys Branch upper marl member at locality 10.

Occurrence. — In the Moodys Branch formation greensand member: rare to common at locality 10; rare at locality 11; rare to common at localities 12 and 20; abundant at locality 22; rare to common at locality 24. In the upper marl member: abundant at locality 10; common at localities 11 and 22; rare

at locality 24. In the Yazoo formation lower beds (facies): common to abundant at locality 1; rare at localities 4 and 5; common to abundant at locality 6; abundant at locality 7; common at locality 11; rare at locality 13; rare to common at locality 16. In the Yazoo formation upper beds (facies): rare at locality 14; common at locality 15. In the North Twistwood Creek clay member: common to abundant at locality 20; common at locality 22; abundant at locality 23; rare to abundant at localities 25 and 28; common to abundant at localities 30 and 31. In the Cocoa sand member: rare at locality 31. In the Pachuta marl member: rare to common at locality 26; rare at locality 29. In the Shubuta clay member: rare at locality 29.

CYTHERELLOIDEA OUACHITENSIS Howe 1934

Pl. 26, figs. 13-15

Cytherelloidea ouachitensis Howe, 1934, Jour. Paleo., vol. 8, no. 1, pp. 32, 33; Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 8, 9, pl. 5, fig. 3; Monsour, 1937, AAPG Bull., vol. 21, no. 1, p. 89; Sexton, 1951, Jour. Paleo., vol. 25, no. 6, pp. 808, 810, pl. 115, fig. 20.

Cytherelloidea danvillensis Howe, 1934, Jour. Paleo., vol. 8, no. 1, p. 31; Howe and Chambers, 1935, La. Dept. Cons. Geol. Bull. 5, pp. 6, 7, pl. 5, fig. 6; Sexton, 1951, Jour. Paleo., vol. 25, no. 6, pp. 808, 810, pl. 115, fig. 19.

Diagnosis. — Female: A rounded medial rib loops around the subcentral sulcus forming a circular pattern that encloses all but a very small part of the dorsal side of the sulcus. A short, longitudinal branch rib connects the circular rib with the posterior border. Male: Male valves are flatter and smaller than the female. A rounded medial rib nearly encircles a deep subcentral sulcus.

Brief description. — Female: Posterior edge is elevated. A high rounded rib extends subperipherally along the dorsal, ventral and anterior margins. A rounded medial rib loops around the subcentral sulcus forming a circular pattern that encloses all but a very small segment of the dorsal part of the sulcus. A short, longitudinal branch rib connects the circular rib with the posterior edge. Muscle scar is typical for the genus. Hingement is adont. Male: Male valves are flatter and smaller than the female. The posterior margin is obliquely truncate. A rounded subperipheral rib extends around all margins. A

rounded medial rib nearly encircles a deep subcentral sulcus and another longitudinal rib, below the medial rib, tends to be concentric with the medial rib. Muscle scar is typical for the genus. Hingement is adont.

Dimensions. — Plesiotype no. 6528, a female right valve from the Yazoo formation upper beds at locality 19: length 0.68 mm., height 0.40 mm.

Types. — All types are from the Yazoo formation upper beds at locality 19.

Occurrence. — In the Yazoo formation lower beds (facies): common at locality 1; rare at localities 4, 5, 11 and 13; rare to common at locality 16. In the Yazoo formation upper beds (facies): common to abundant at locality 9; rare to abundant at locality 14; common at locality 19. In the Shubuta clay member: rare at localities 26 and 27.

EXPLANATION OF PLATE 1

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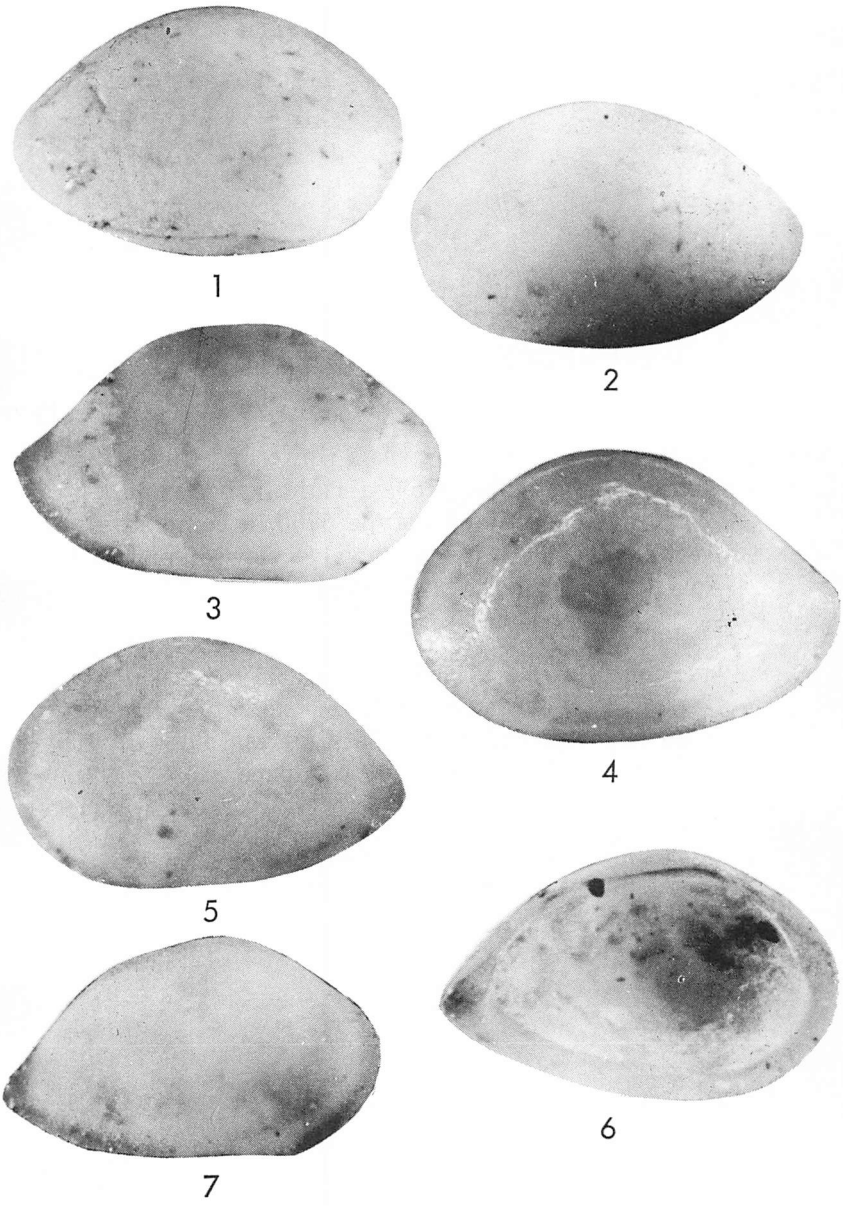

Plate 1, Bairdiidae

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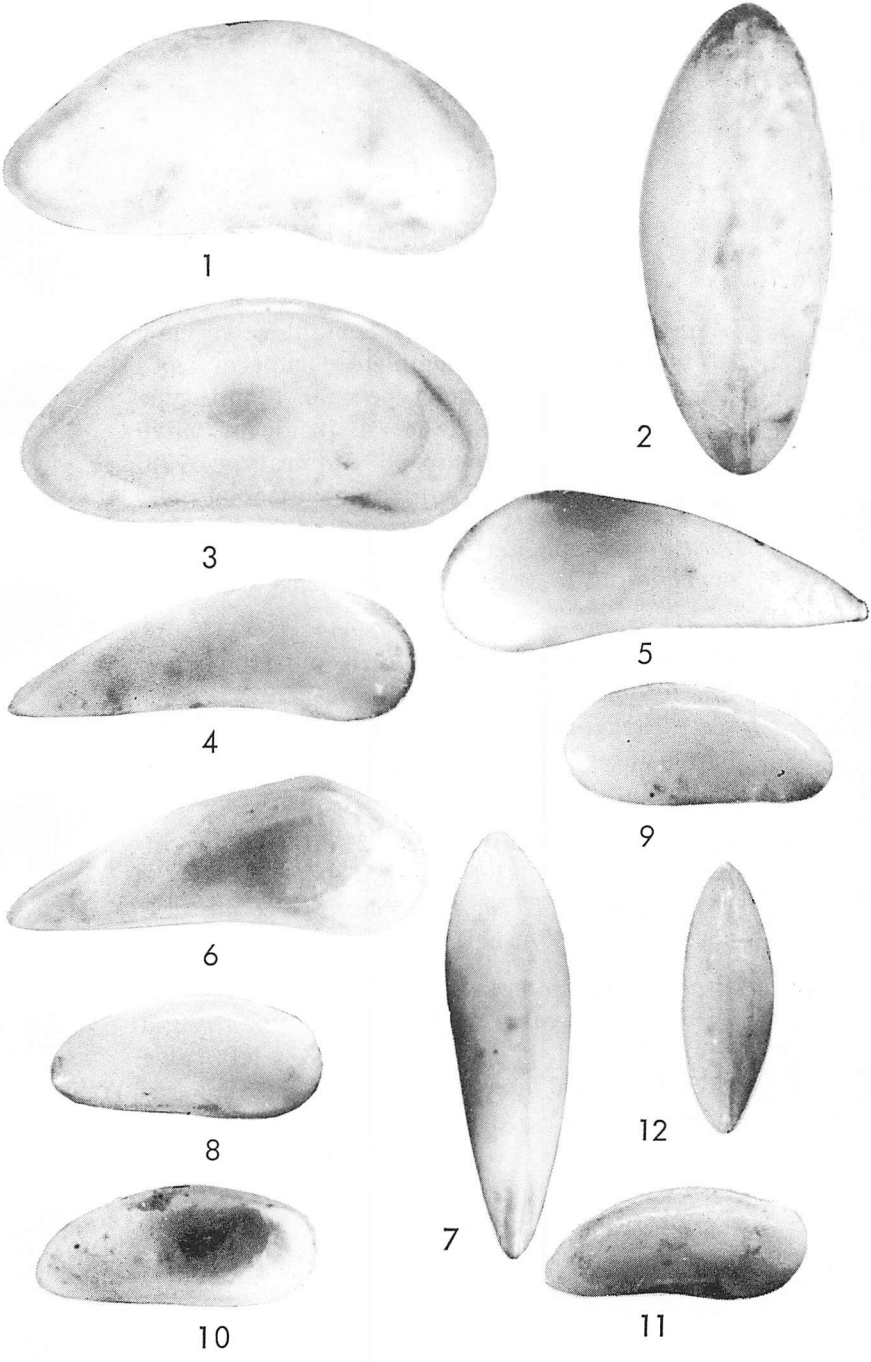

Plate 2. Bairdiidae, Paracyprididae

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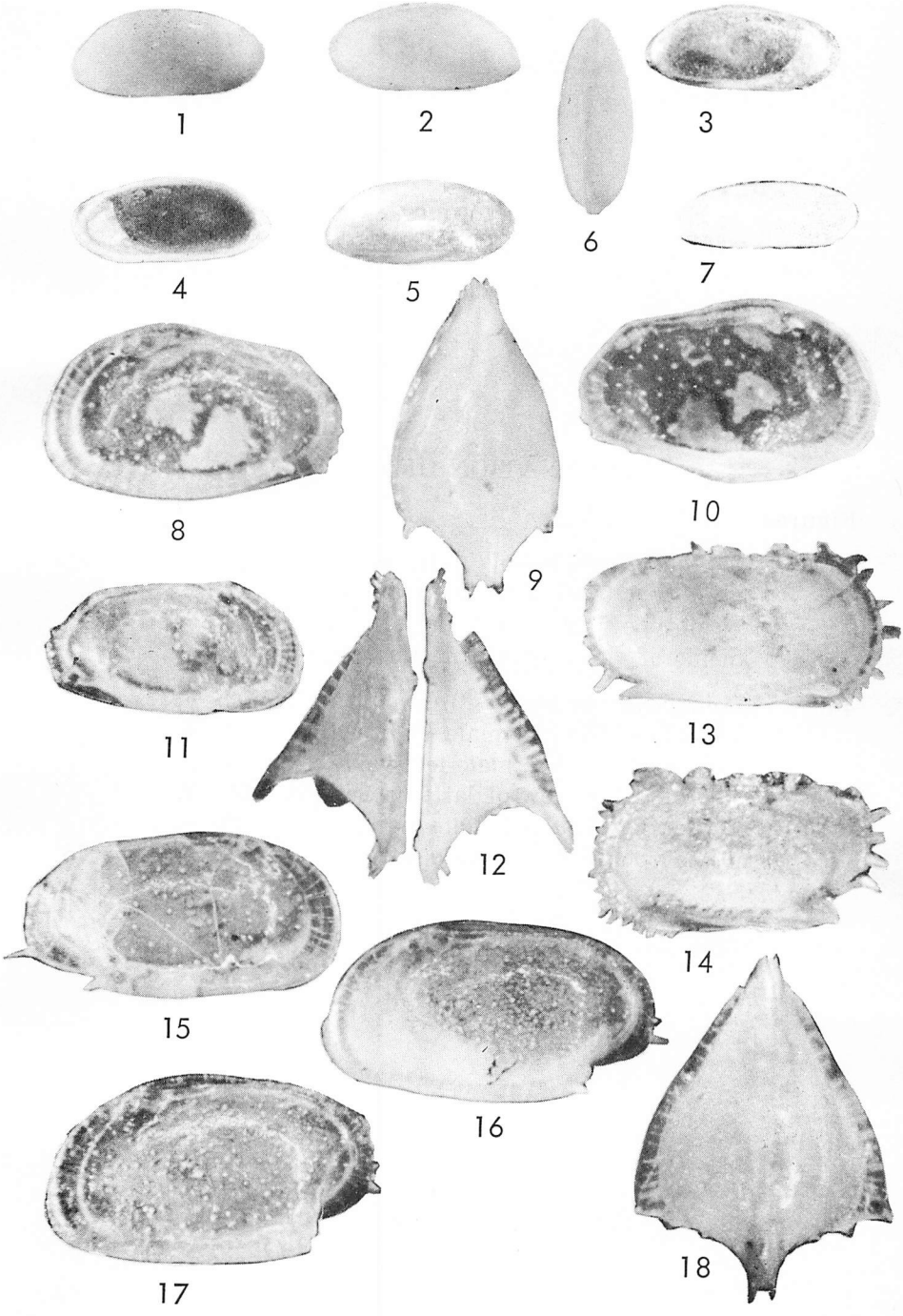

Plate 3. Pontocyprididae, Brachycytheridae

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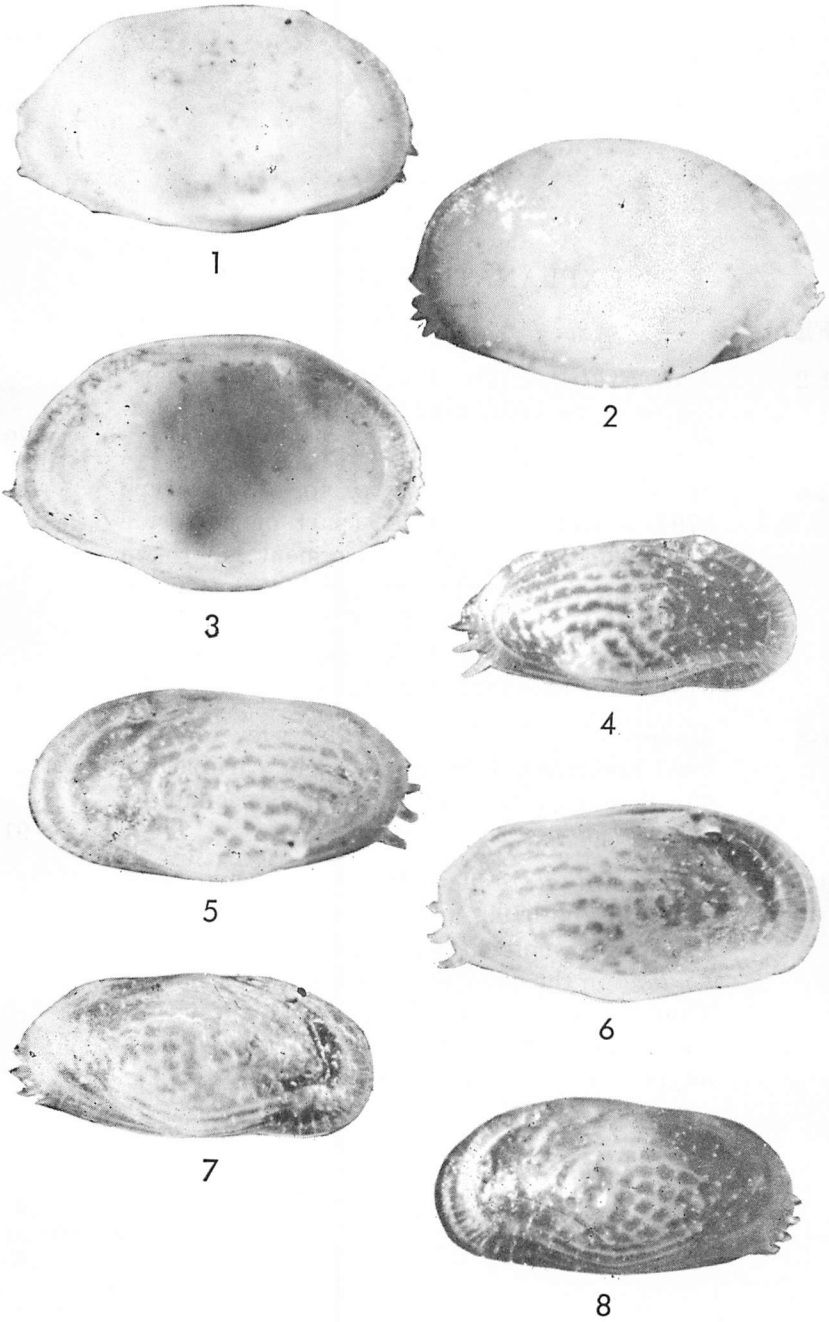

Plate 4. Brachycytheridae

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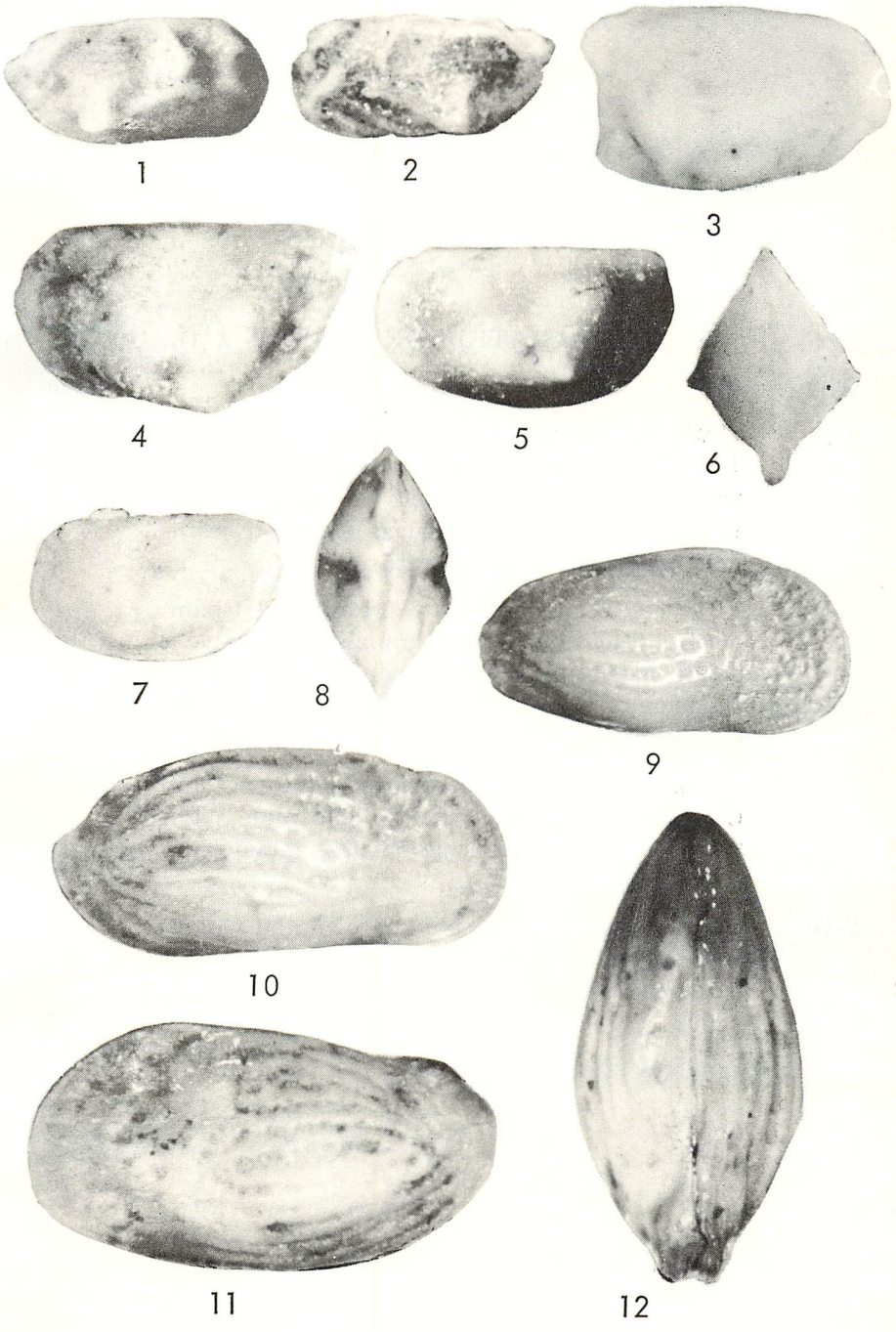

Plate 5. Bythocytheridae, Cytherettidae

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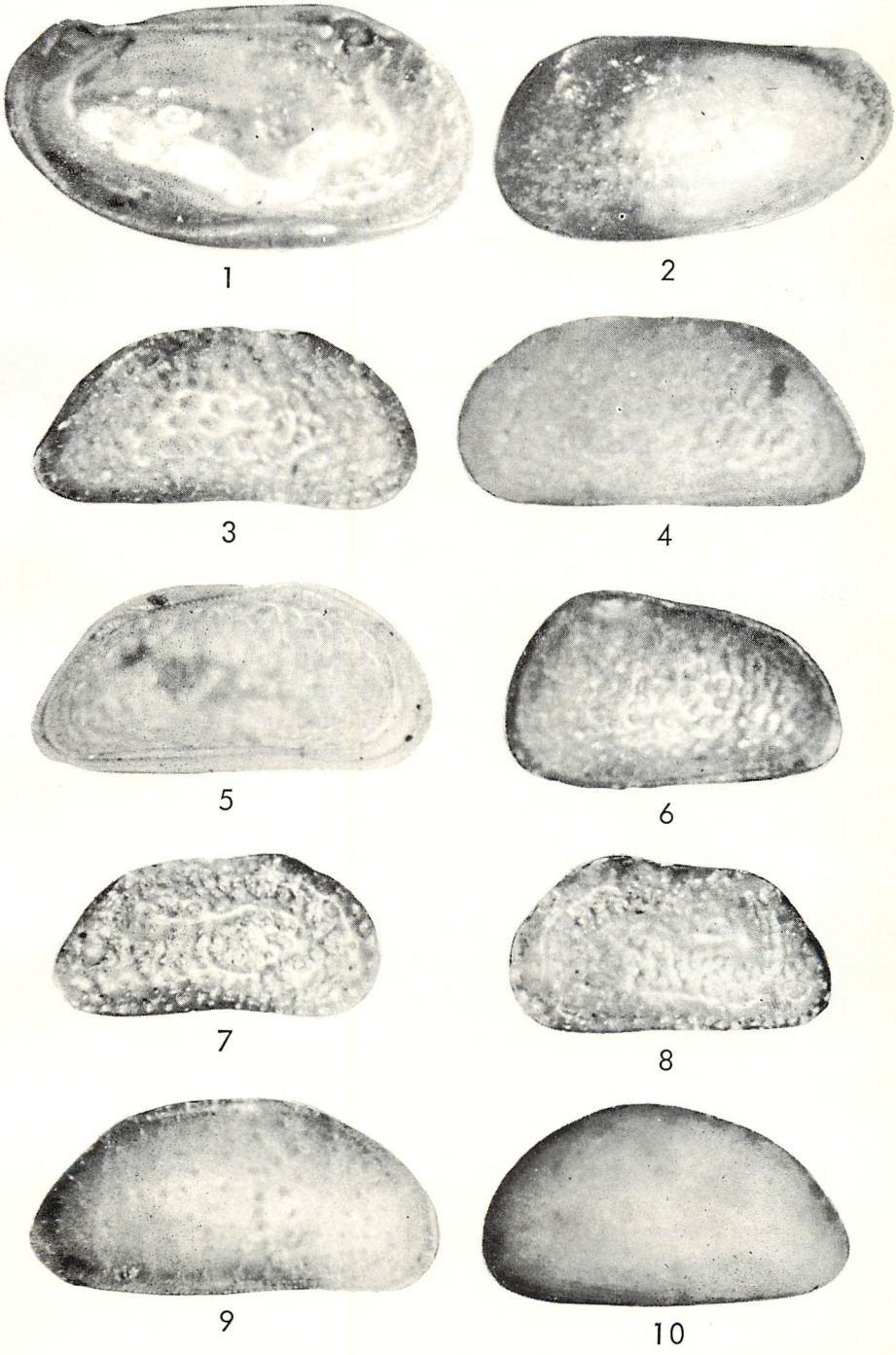

Plate 6. Cytherettidae, Cytherideidae

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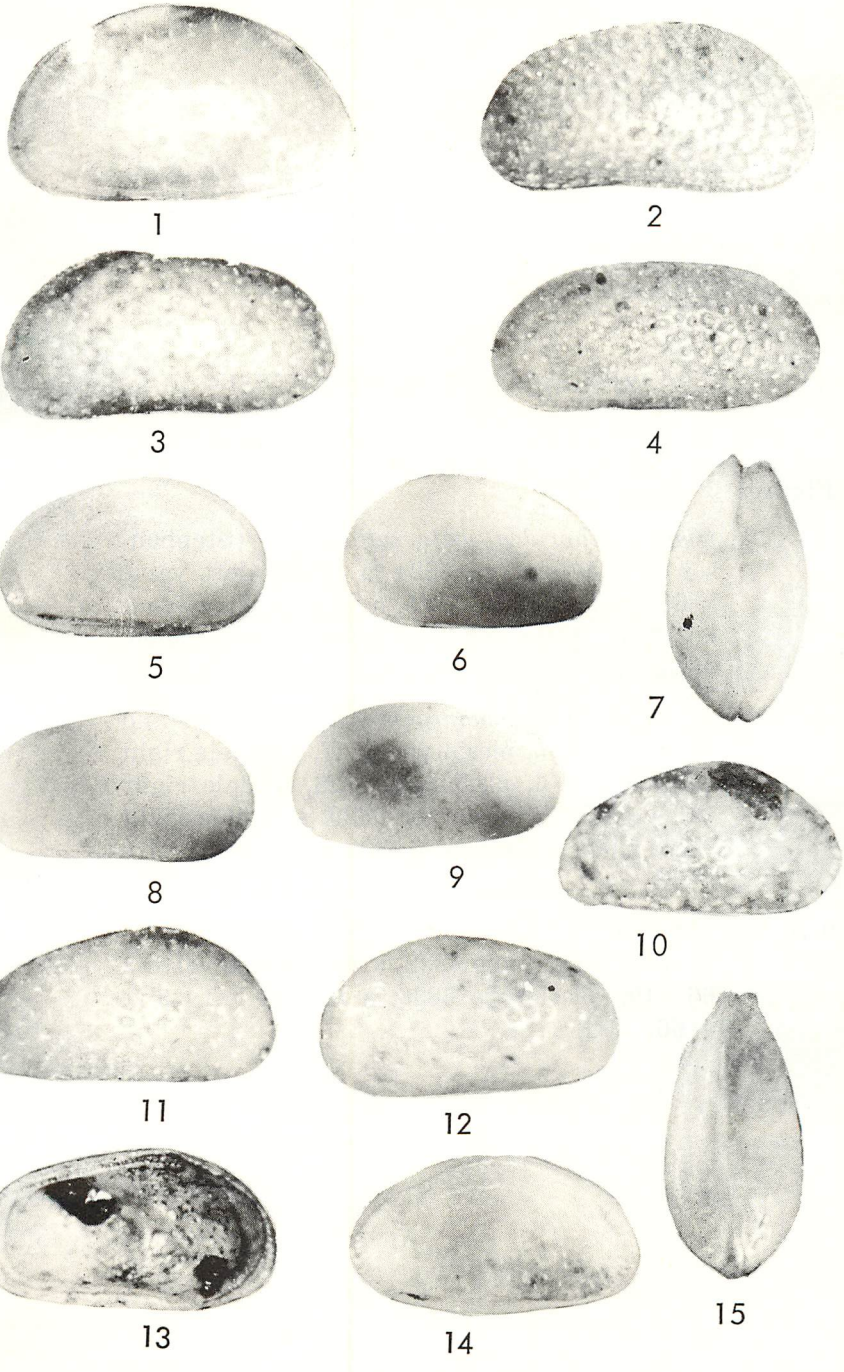

Plate 7. Cytherideidae

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EXPLANATION OF PLATE 8

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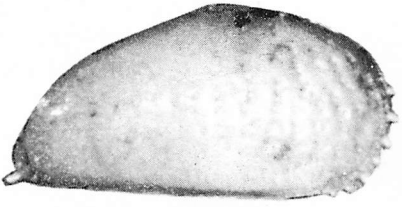

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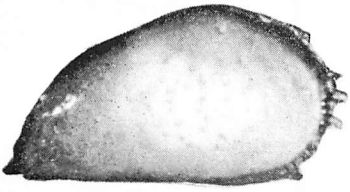

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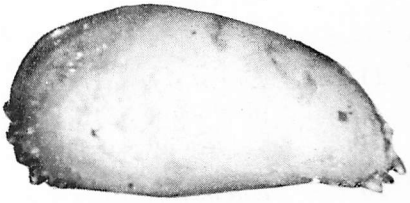

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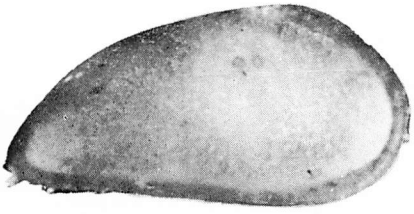

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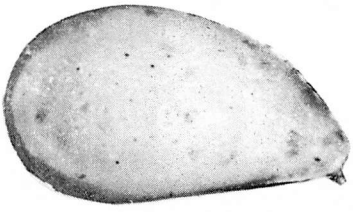

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Plate 8. Cytherideidae

EXPLANATION OF PLATE 9

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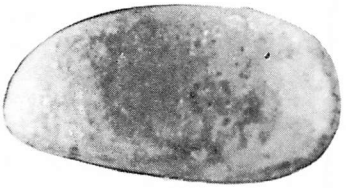

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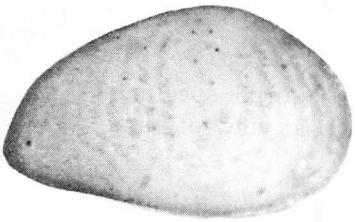

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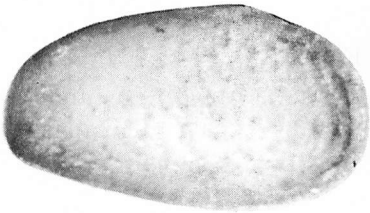

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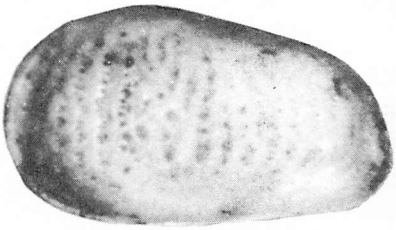

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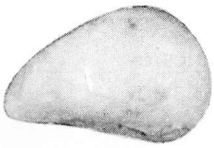

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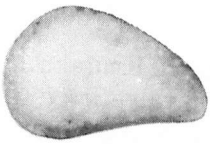

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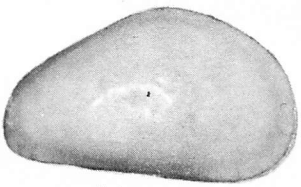

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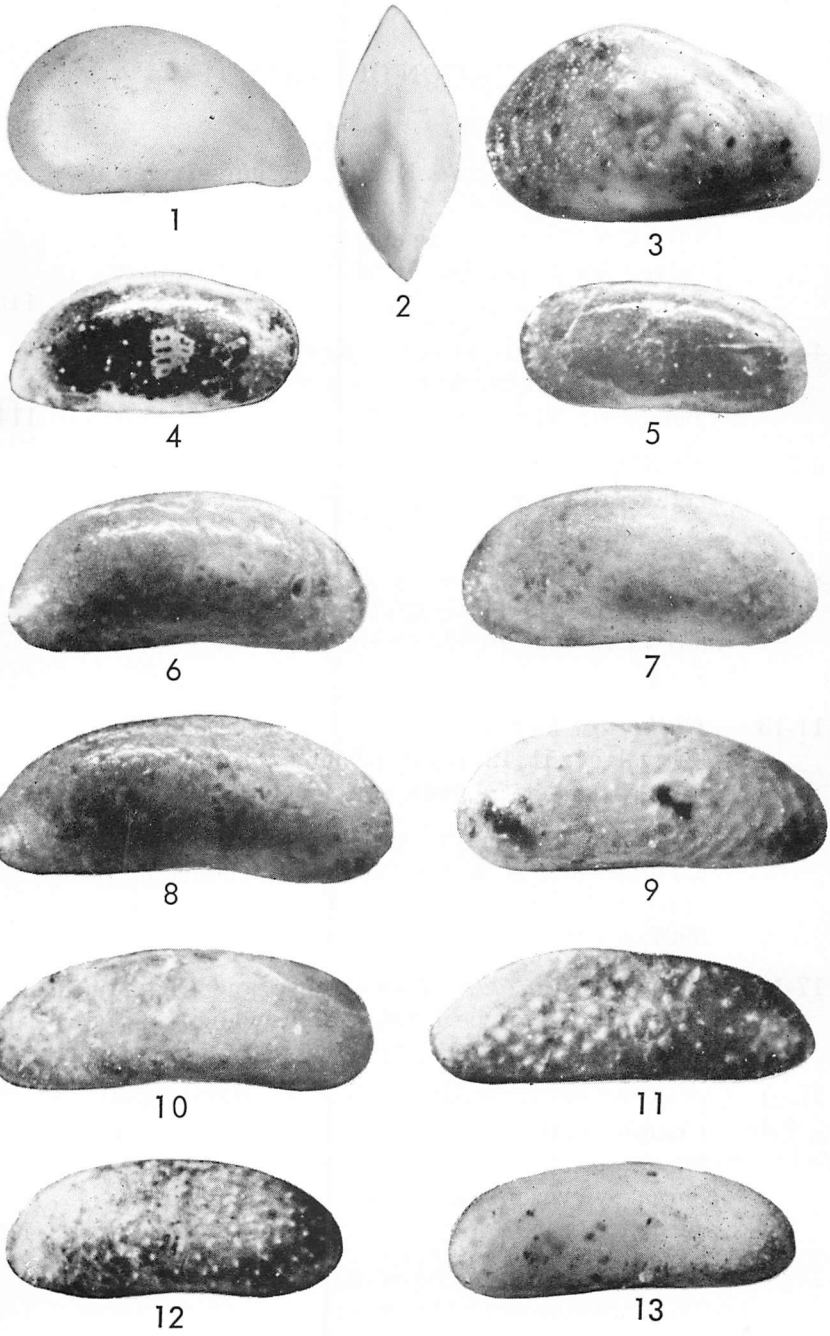

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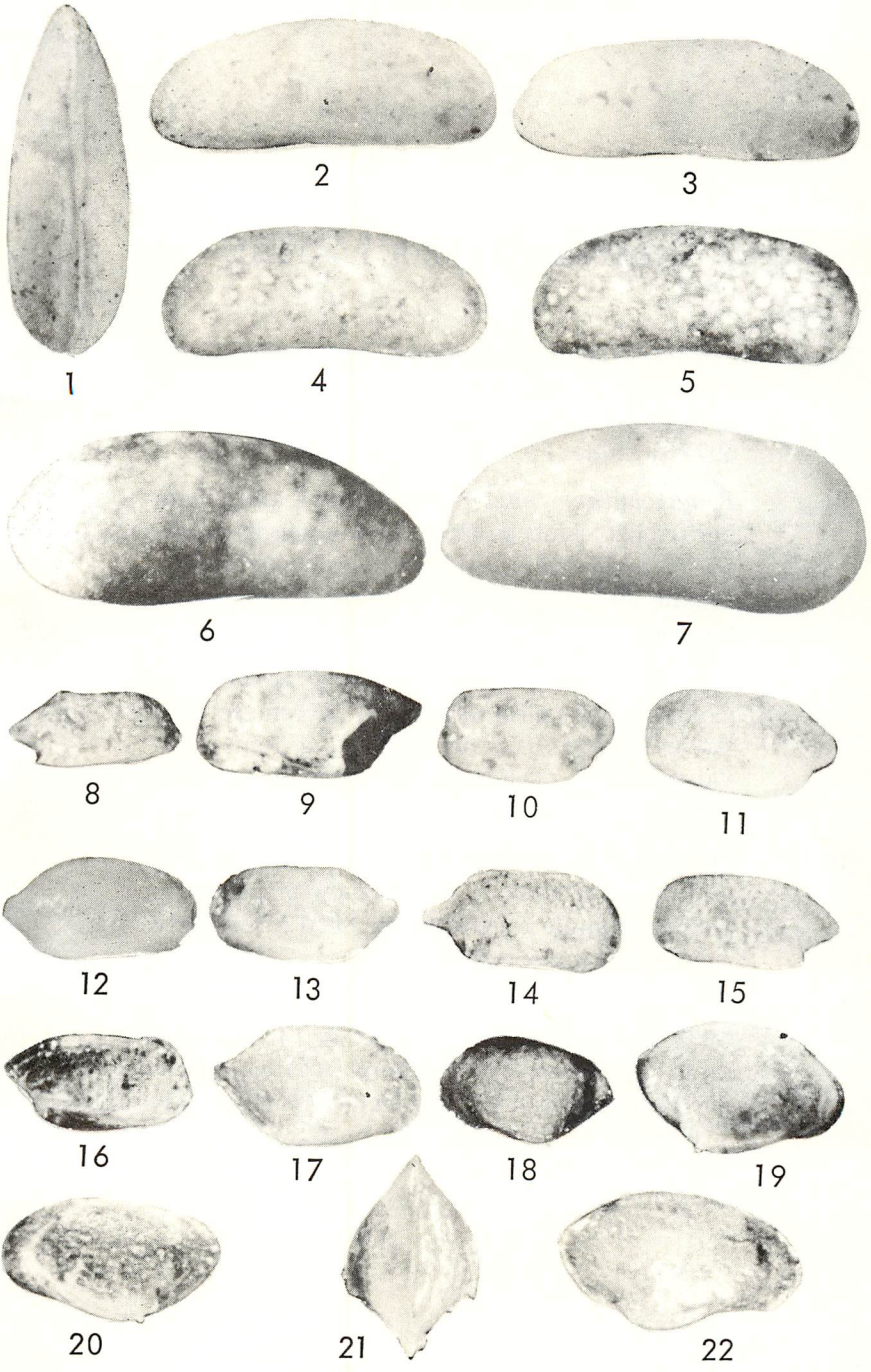

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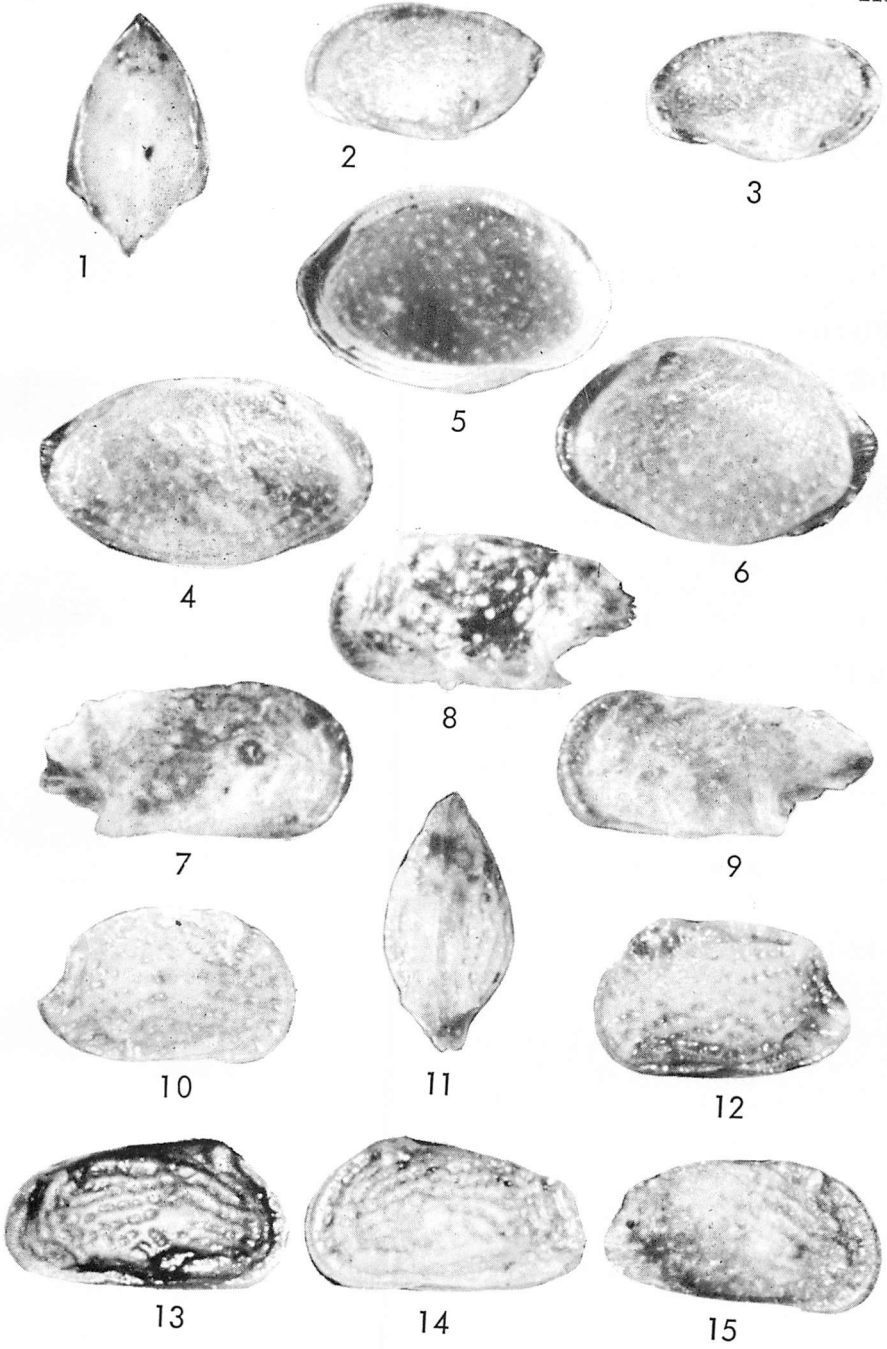

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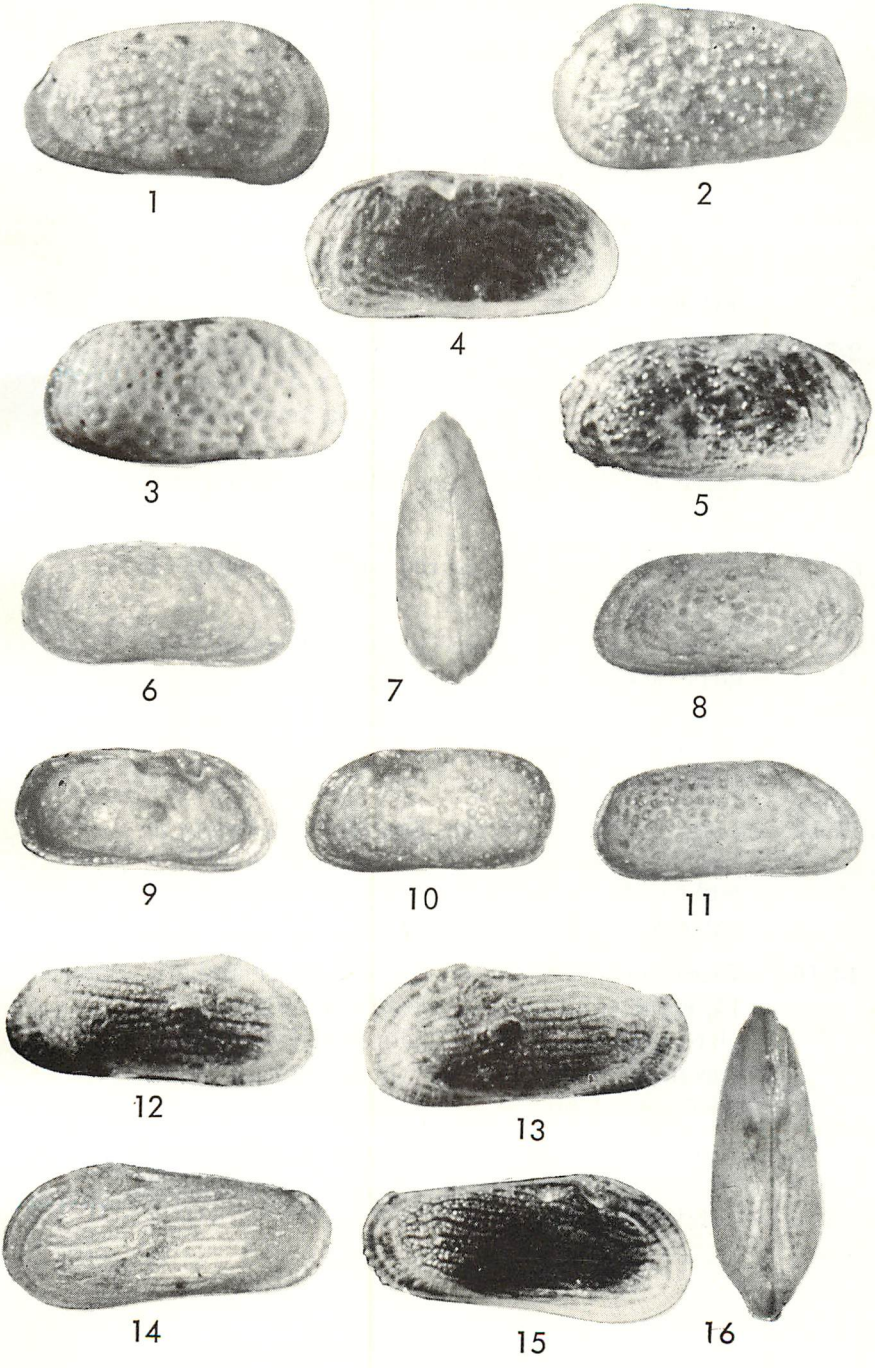

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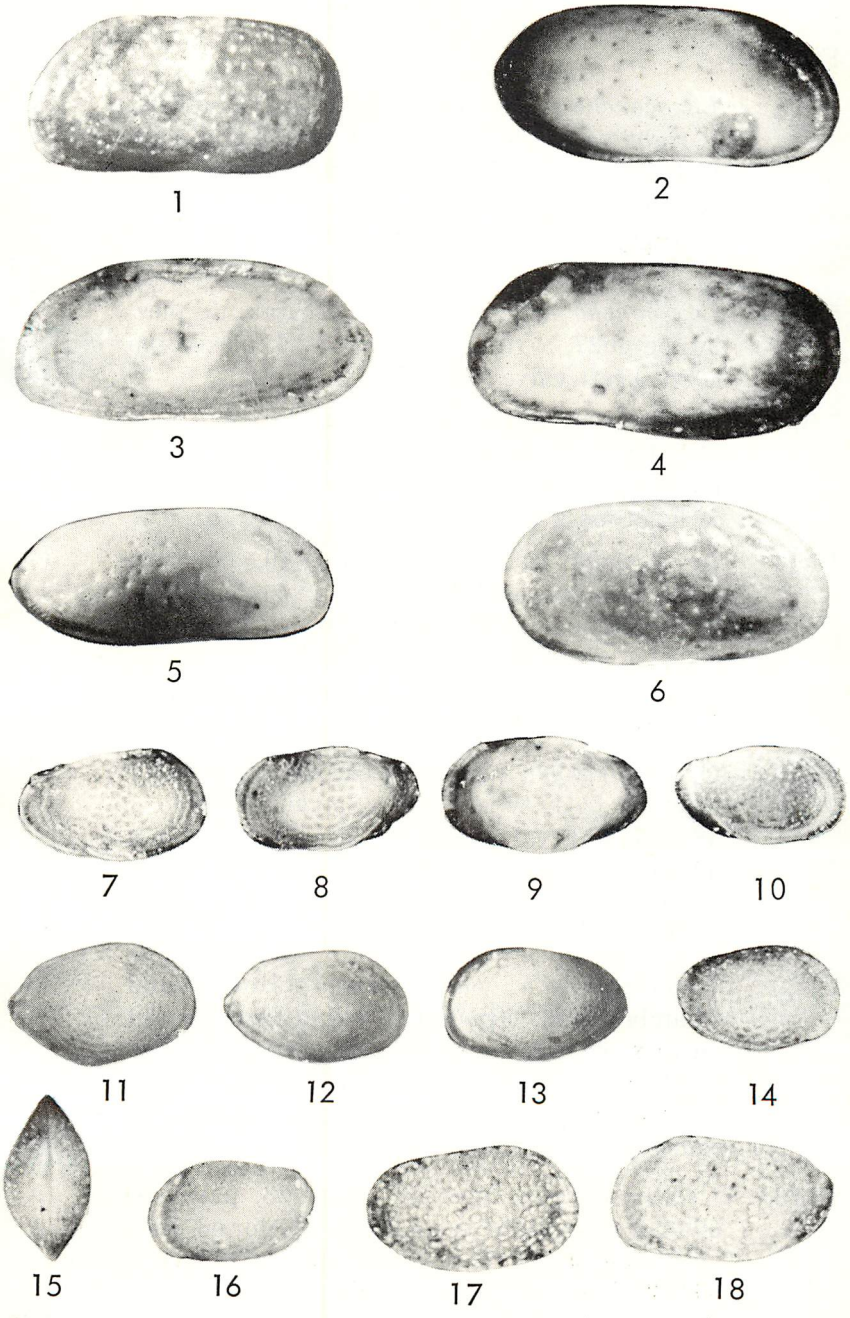

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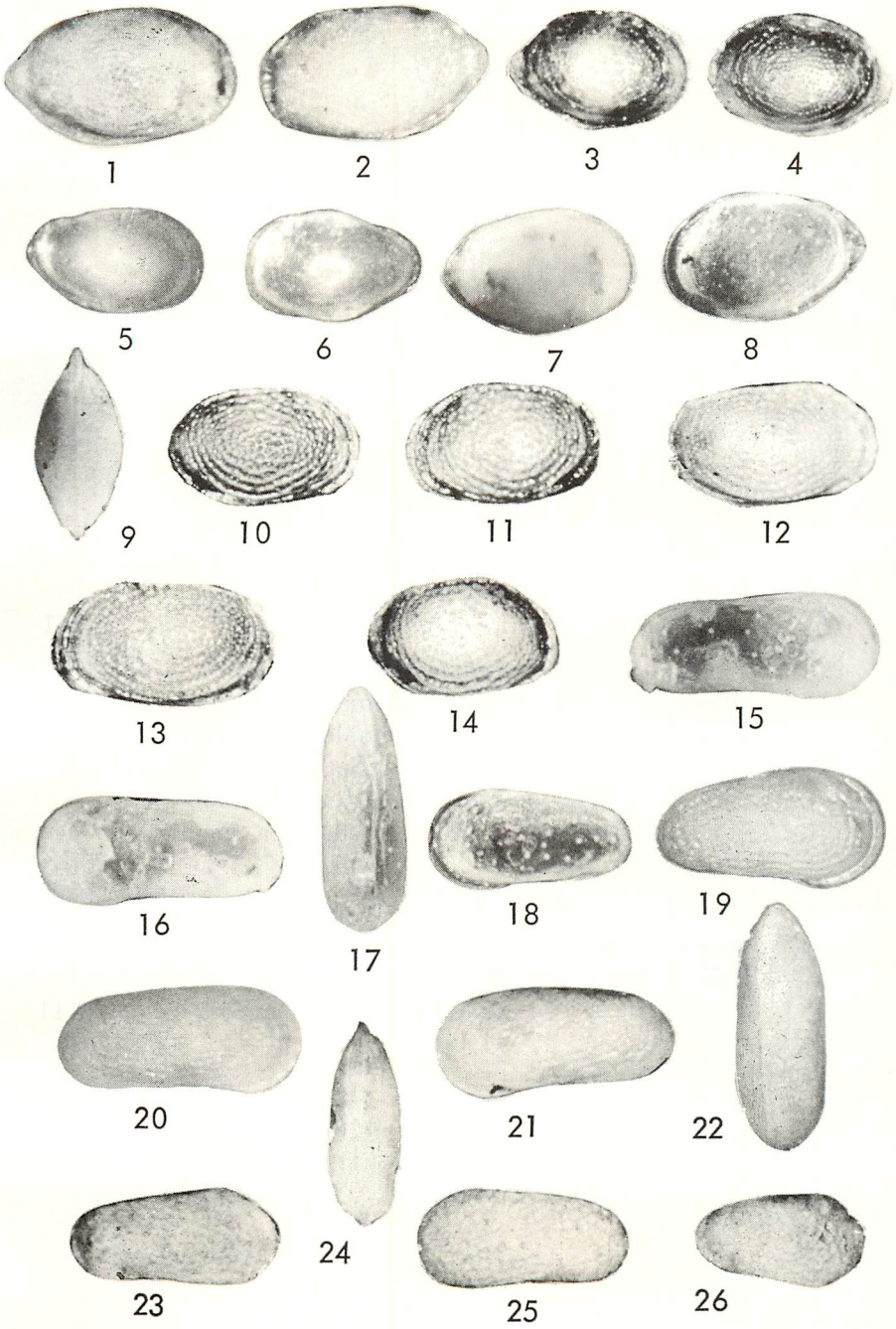

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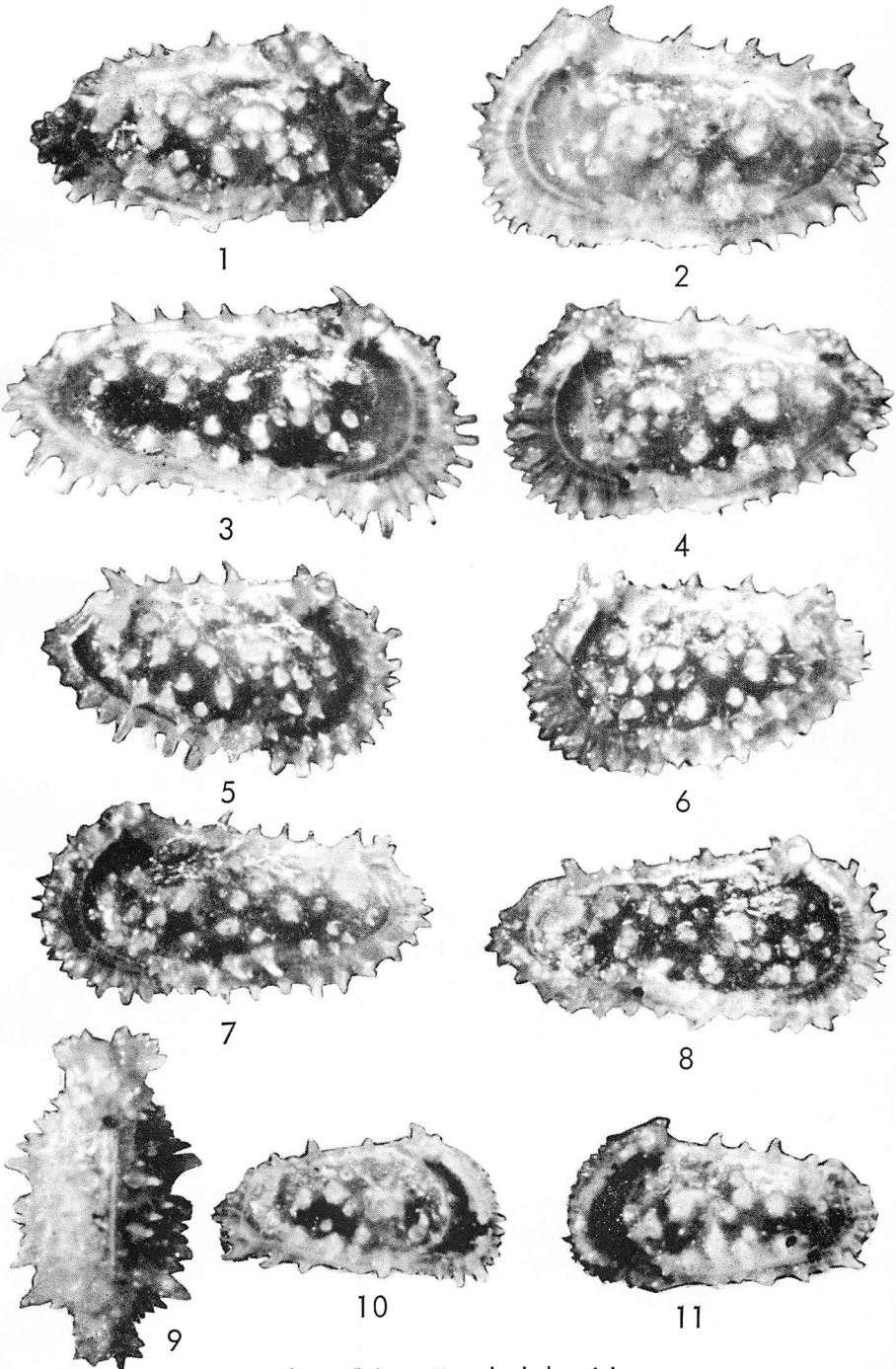

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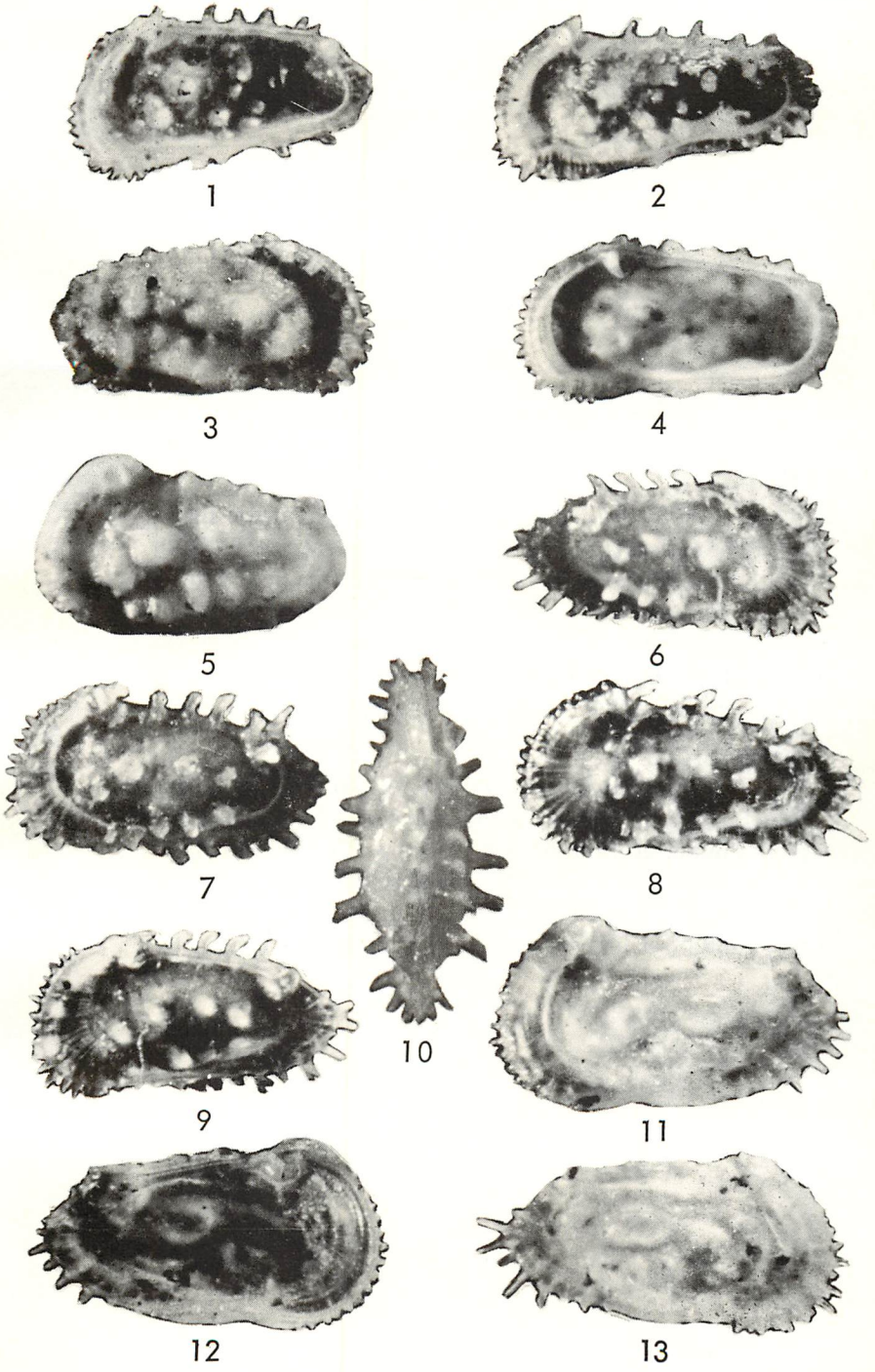

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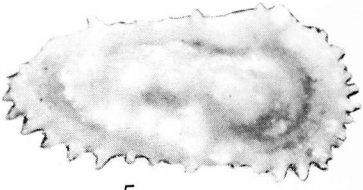

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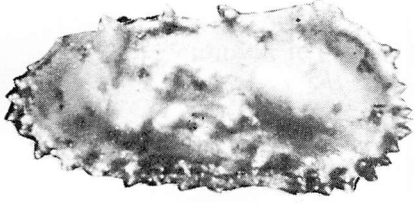

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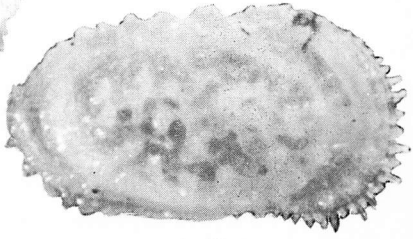

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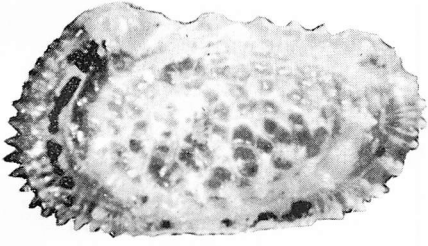

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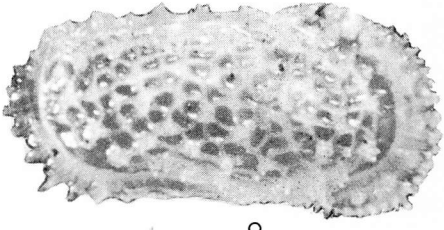

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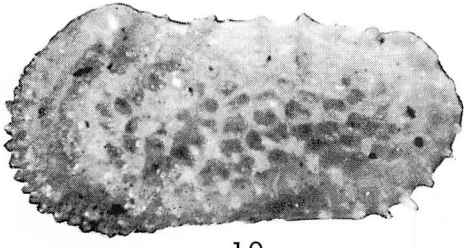

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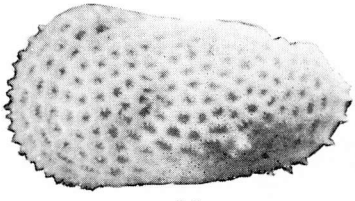

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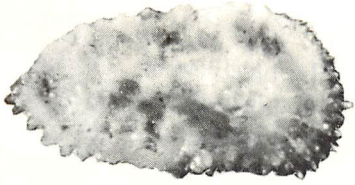

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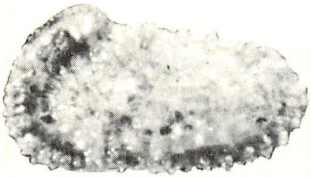

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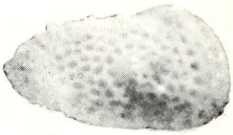

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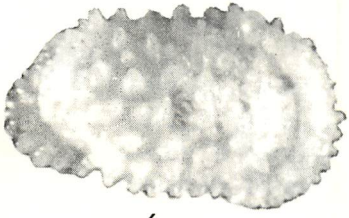

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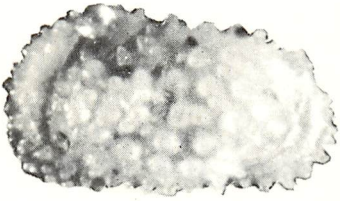

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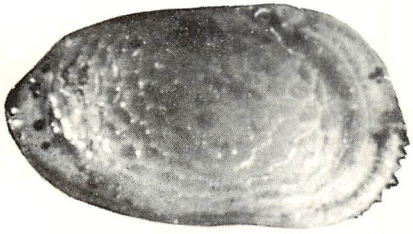

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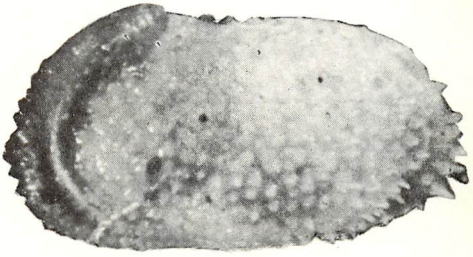

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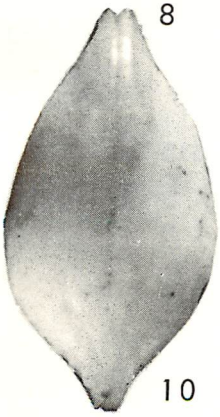

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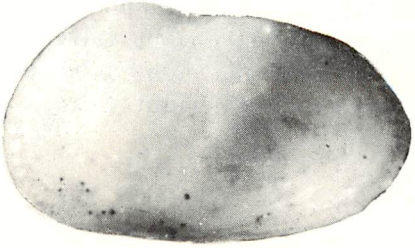

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Plate 19. Trachyleberidae

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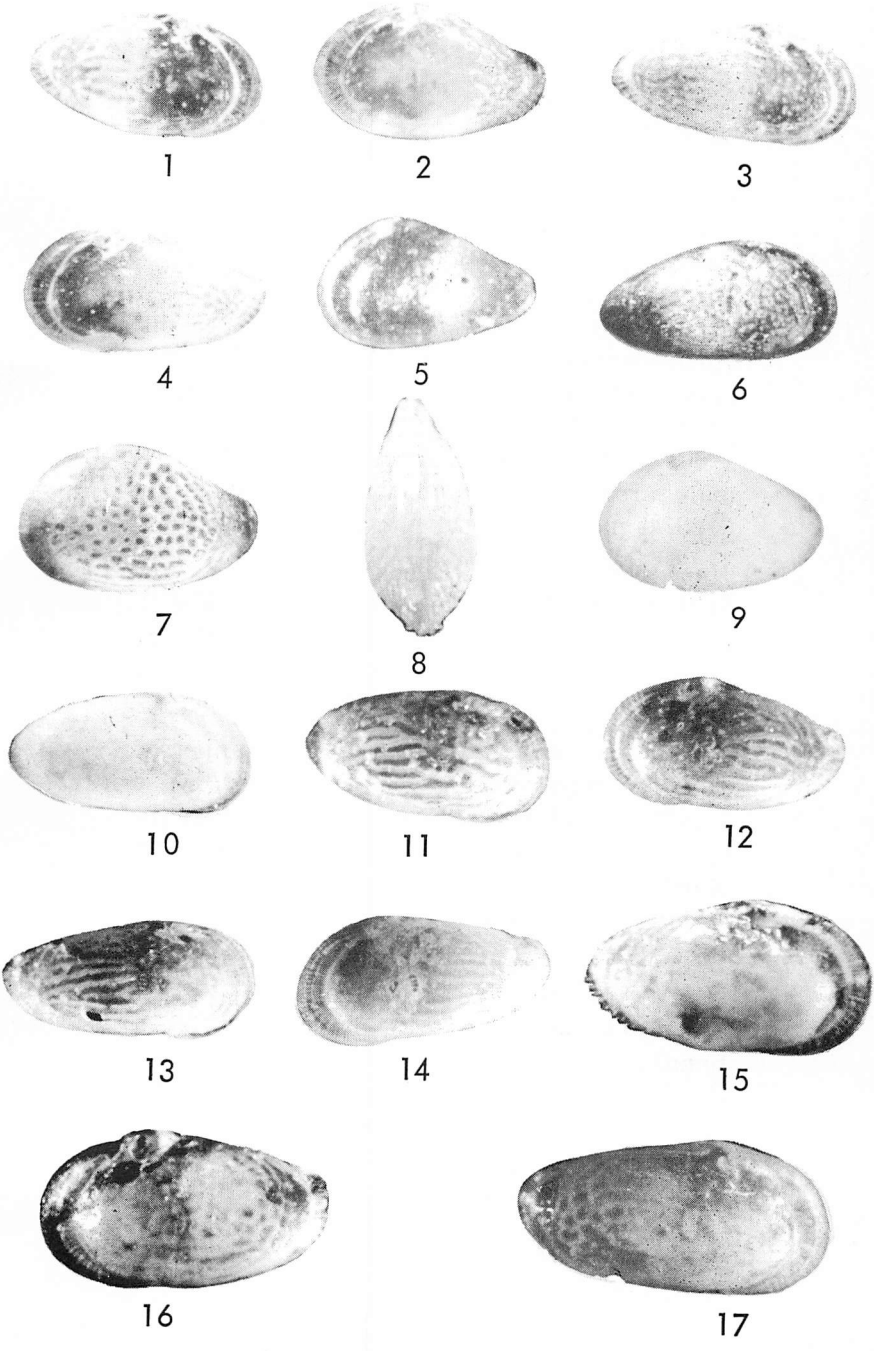

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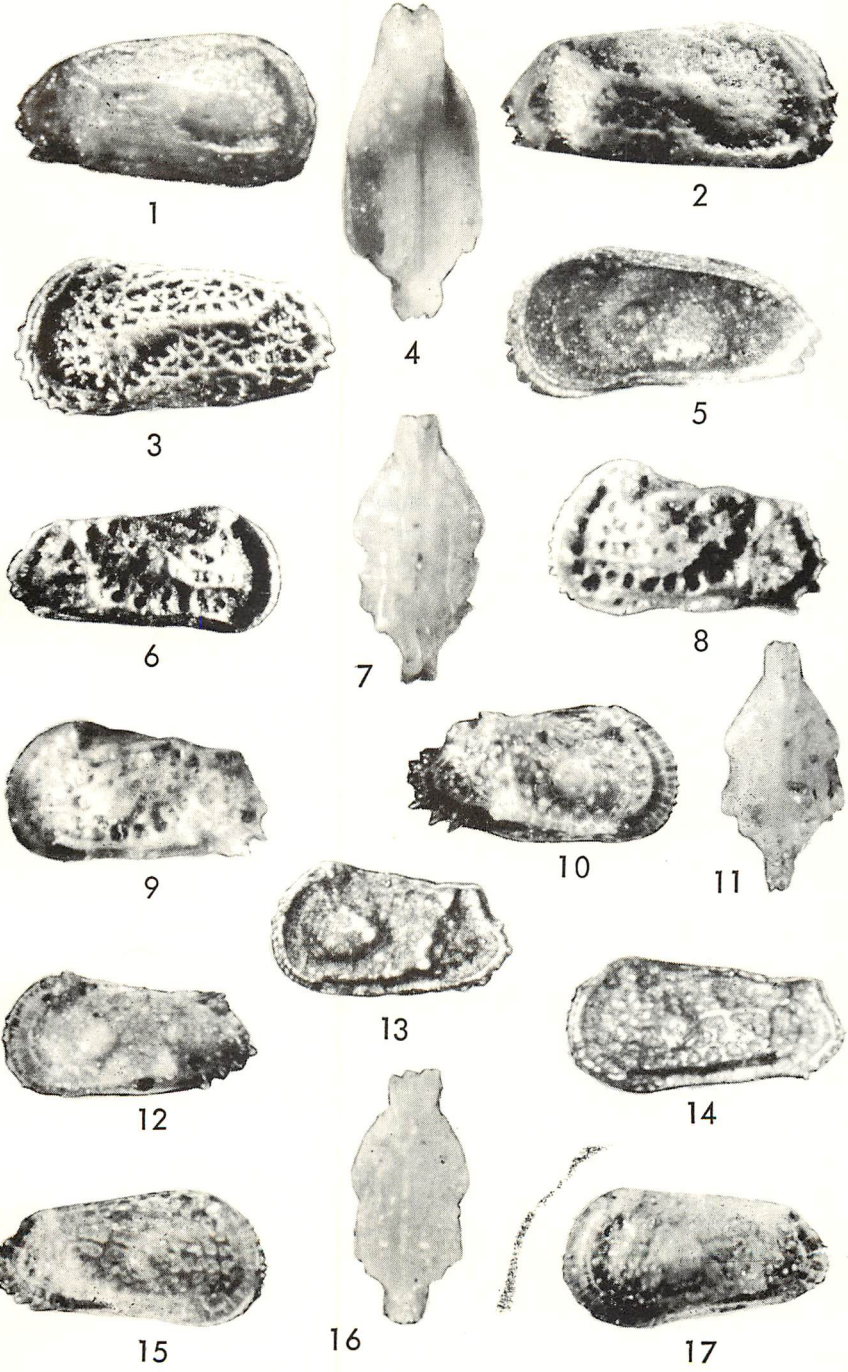

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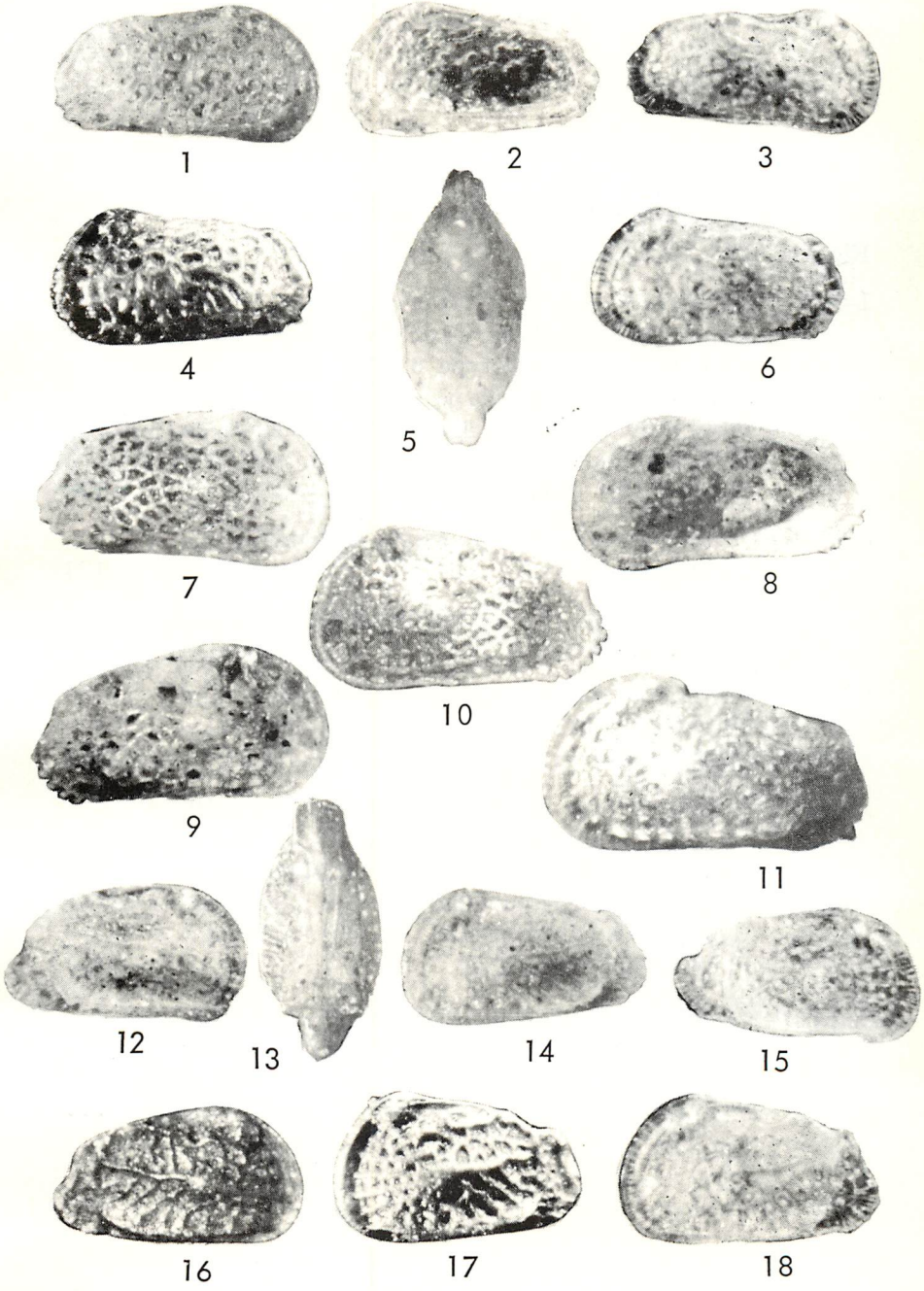

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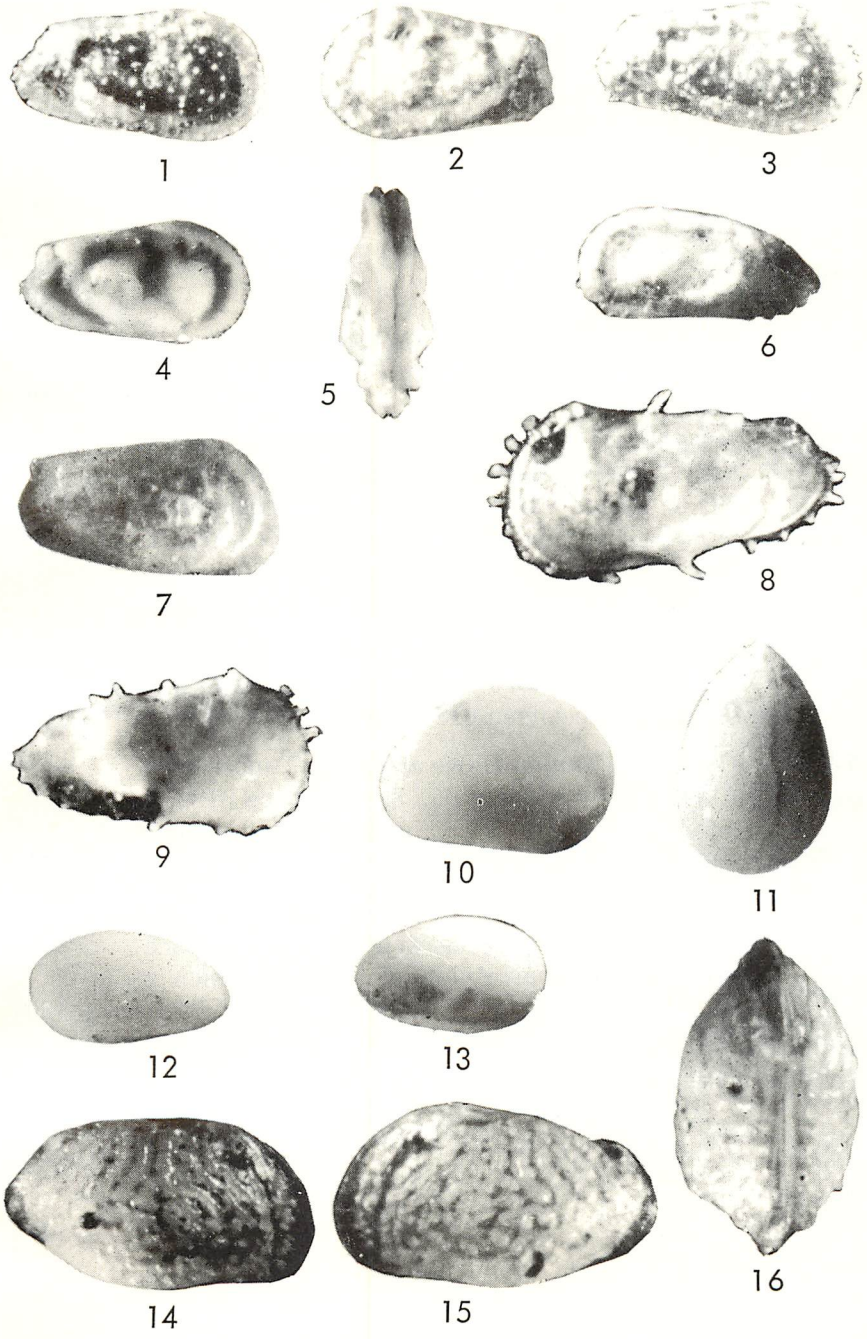

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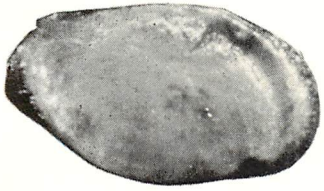

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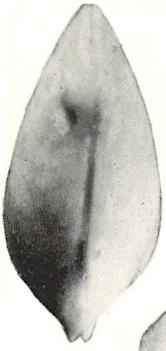

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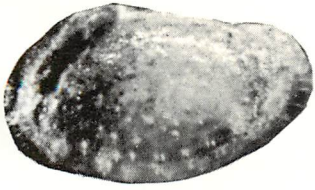

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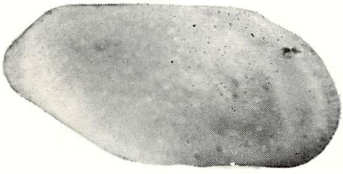

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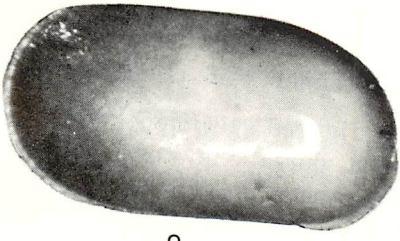

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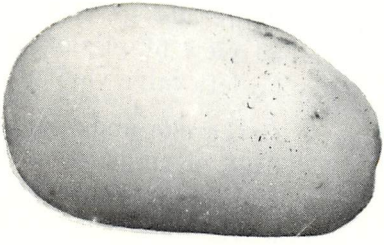

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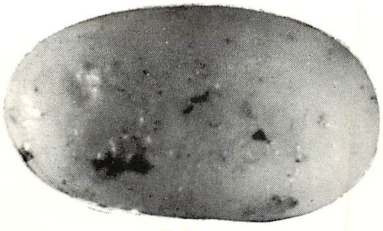

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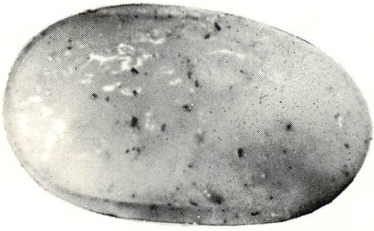

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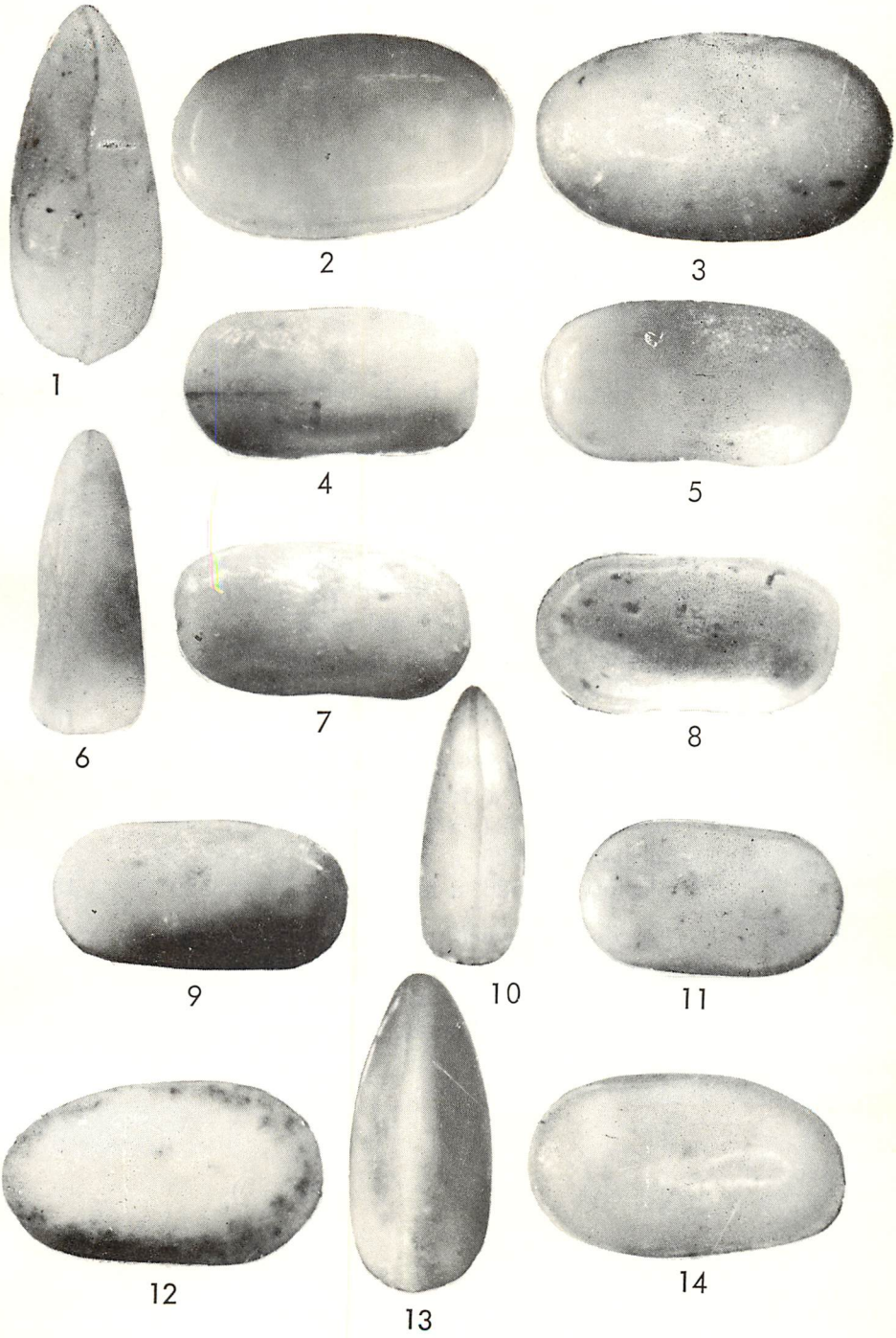

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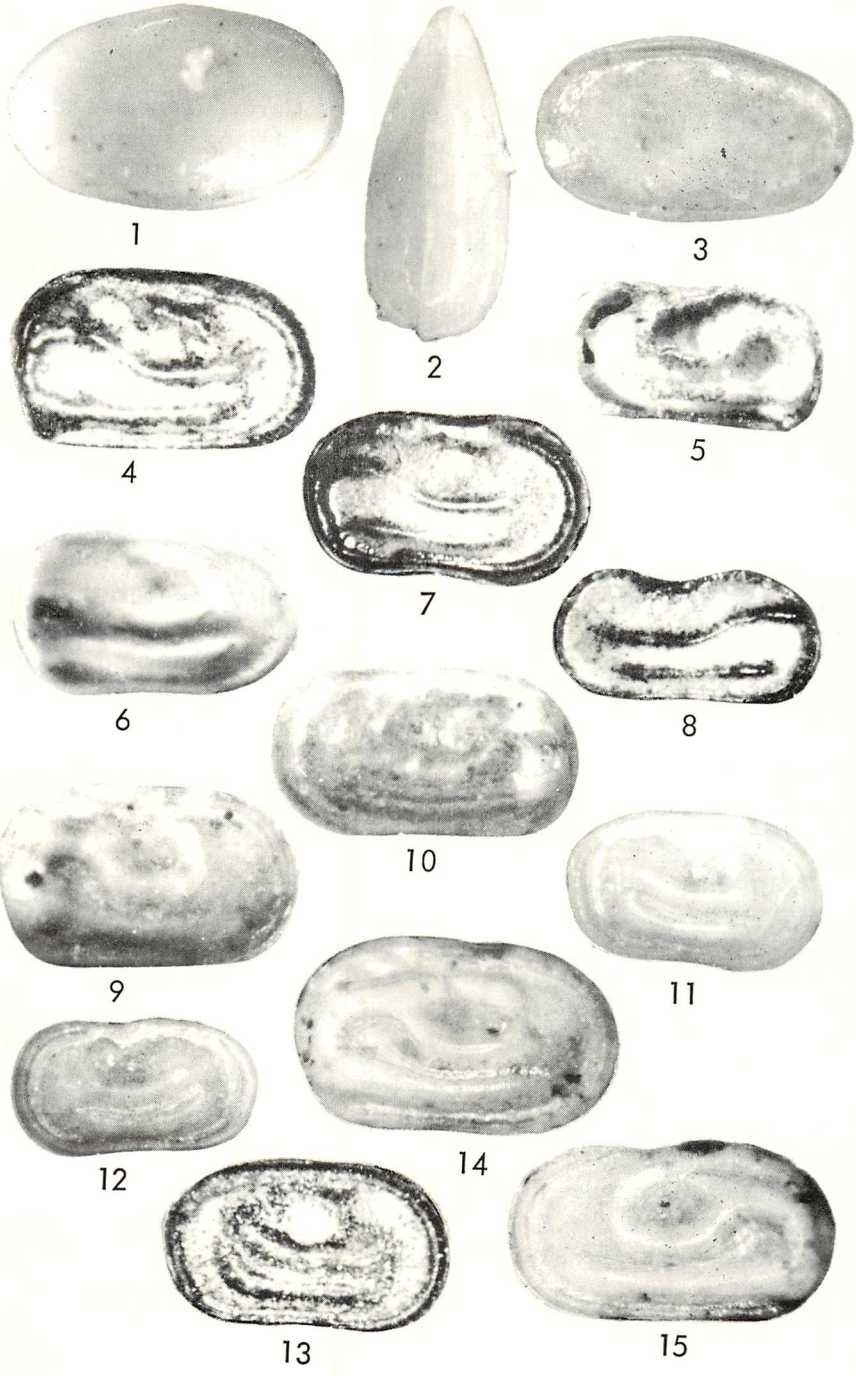

Plate 26. Cytherellidae

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SAMPLE LOCALITIES AND DESCRIPTIONS

The following descriptions of samples (or zones of sections from which samples were collected) are made from surface exposures or cuttings and cores from drill holes used in this study. Generally, only the sample or sampled interval is described, but the entire section is described for surface exposures. Thicknesses and depths are given in feet.

Samples are identified by locality number and letter. For example, at locality one the sample from the lowest stratigraphic level is 1A and the next succeeding samples, higher in the section, are labeled 1B, 1C, etc. in sequence. The same procedure is followed at all localities. See plate 27 (in pocket) for distribution of localities.

Locality one: Stratigraphic Test of Type Locality of Yazoo Formation.

Location: SE/SW/SE of Sec. 32, T12N, R2W, Yazoo County, Mississippi. In Yazoo City, Mississippi. Drilled October 4, 1963.

Elevation: 258.83 feet

Depth (feet)	Samples	Description (after William H. Moore)
0 - 17		no core
17.0 - 26.0		Silt, tan to yellow, streaked with yellow and gray, slightly calcareous.
26.0 - 28.0		Silt as above with gravel, some very large.
28.0 (top)		**Yazoo formation.**
28.0 - 29.0		Clay, blue-gray, non-calcareous.
29.0 - 46.5	1G	Clay, blue-gray, fossiliferous, some streaks of
	(at 40-44 ft.)	glauconite, possibly pyritic material.
Spot cores		
70.0 - 71.0	1F	Clay, blue-gray, fossiliferous.
100.0 - 101.0	1E	Clay, gray, very fossiliferous.
120.0 - 122.0	1D	Clay, gray, very fossiliferous, pyritic in part.
140.0 - 142.0	1C	Clay, gray, fossiliferous, finely micaceous.
160.0 - 161.0	1B	Clay, gray, very fossiliferous, rare pyrite.
180.0 - 181.0	1A	Clay, gray, very fossiliferous.
187.0 - 191.0		Contact with Moodys Branch formation.

Remarks: Cored from 0 to 40.5 feet with spot cores at 70 feet, 100 feet, 120 feet, 140 feet, 160 feet and 180 feet.

Locality Two: Surface Outcrop of Type Section of Yazoo Formation.

Location: In southern part of Yazoo City, Mississippi, where Yazoo River makes a large meander. This section begins at the eastern edge

of the Yazoo River channel and proceeds to a point on Mississippi State Highway No. 3, (Washington Street) which is approximately 175 yards south of the intersection of Holmes and Washington Streets. The section then continues eastward up a large hill to Ridge Road on top.

Elevation: 342.0 feet approximately at top of a loess bank on Ridge Road.

Thickness Feet	Samples Feet	Description
50.0 estimated. Contact with Citronelle is under cover.		Loess
15.0		Silt, massive buff to brown, argillaceous
35.0		Cover
25.0 estimated. Both upper and lower contacts are under cover.		**Citronelle formation (?)**
25.0		Cover
120.0 estimated above level of Hwy. 3. Upper contact under cover.		**Yazoo formation**
25.0		Cover
1.0	2E (approx. 1 ft. below cover zone)	Clay, grayish-buff, badly slumped and weathered, limonite stained, silty, calcareous, slightly fossiliferous.
10.0	2D (approx. 10 ft. below 2E above)	Clay, grayish-buff, badly slumped and weathered, limonite stained, silty, calcareous, slightly fossiliferous.
1.0		Clay, grayish-buff, badly slumped and weathered, limonite stained, silty, calcareous, slightly fossiliferous.
12.0		Cover
8.0	2C (approx. 8.0 ft. below cover and 20.0 below 2D above)	Clay, grayish-buff, badly weathered, silty, calcareous, slightly fossiliferous.
10.0		Clay, grayish-buff, badly weathered, silty, calcareous, slightly fossiliferous.
30.0		Cover
3.0	2B (approx. 3.0 ft. below cover zone and approx. 15.0 ft. above 2A below.)	Clay, grayish-green fresh, weathers buff, badly weathered, blocky, calcareous, slightly fossiliferous.

15.0	2A (collected approx. 5.0 ft. above road level)	Clay, grayish-green fresh, weathers buff, badly weathered, blocky, calcareous, slightly fossiliferous.
5.0		Clay, gray to buff weathered, blocky, calcareous.
147.0 elev. (from topo map)		Roadbed of Mississippi State Highway No. 3, 175 yards south of Holmes Street.
73.0		Cover to edge of water of channel of Yazoo River.

Remarks: This section is badly weathered and slumped and is mostly under cover. The samples were taken from the east bank of the road cut of Mississippi State Highway No. 3 and from badly slumped banks of a ravine farther up the hill.

Locality Three: Test Hole 38 of Mississippi Clay Products Company.

Location: South of Yazoo City, Mississippi, approximately in the center of SE¼, Sec. 6, T11N, R2W, Yazoo County. Drilled August 26, 1960.

Elevation: 225 feet

Depth (feet)	Samples	Description (after Frederic F. Mellen and Wentworth V. Harned)
6.0 (top)		**Yazoo formation**
7.0 - 9.0	3J (7.0′ depth)	Clay, brown changing to blue, slightly silty and semi-plastic.
9.0 - 13.0	3I	Clay, brown, semi-plastic, effervesces moderately in HC1, silty.
13.0 - 18.0	3H	Clay, brown, silty, semi-plastic, becomes light blue-gray, fossiliferous, effervesces moderately in HC1.
18.0 - 19.3	3G	Clay, dark bluish-gray, semi-plastic, slightly silty, effervesces slightly in HC1.
19.3 - 21.5	3F	Clay, medium bluish-gray, very silty, non-plastic, effervesces moderately in HC1.
21.5 - 28.0	3E (at approx. 25.0′ depth)	Clay, medium bluish-gray, semi-plastic, silty, effervesces moderately in HC1.
28.0 - 32.5	3D	Clay, dark bluish-gray, slightly silty, semi-plastic, fossiliferous, effervesces slightly in HC1.
32.5 - 36.0	3C	Clay, medium bluish-gray, semi-plastic, silty, effervesces moderately in HC1.
40.0 - 45.0	3B (at approx. 43.0′ depth)	Clay, medium bluish-gray, semi-pastic, silty, effervesces moderately in HC1.
45.0 - 48.0	3A	Clay, medium bluish-gray, semi-plastic, silty, fossiliferous, effervesces moderately in HC1.

48.5′ TD

155.0′ estimated depth at top of **Moodys Branch formation.**

Locality Four: Test Hole C-4 Record of Mississippi Geological Survey. See Mellen, 1940, p. 51.

Location: Ed Cooper property (in 1938) in Yazoo County, Mississippi, 135 yards N 68° E of hole C-5; probably in NE¼ NW¼ Sec. 7, T11N, R2W. Drilled August 13, 1938.

Elevation: 210 feet approximately.

Thickness	Depth (feet)	Samples	Description (after Frederic F. Mellen, 1940)
	1.7 (top)		**Yazoo formation**
10.0	58.7	4D (C-7 of MGS)	Clay, plastic, tough, calcareous, non-gypsiferous; contains marine fossils; upper 0.7′ lighter blue and siltier than middle 8.1′; lower 1.2′ siltier than middle 8.1′. (10′ zone)
10.0	77.7	4C (C-9 of MGS, from a zone 10.0′ thick)	Clay, plastic, tough, silty, calcareous, non-gypsiferous, bluish-gray; contains marine fossils.
12.0	91.7	4B (C-11 of MGS)	Clay, plastic, tough, very silty, calcareous, non-gypsiferous, bluish-gray; contains marine fossils.
13.0	101.7	4A (C-12 of MGS)	Clay, semi-plastic, very silty, hard calcareous, non-gypsiferous, bluish-gray; contains fossils.
105.3	TD		Abandoned while still in the same type of clay.

Locality Five: Test Hole Record C-13 of the Mississippi Geological Survey. See Mellen, 1940, p. 58.

Location: F. A. McGraw property (in 1938) in Yazoo County, Mississippi; on hill slope about 200 feet E of Highway 3, 0.5 mile S. of Perry Creek bridge just S. of Valley; in SE¼ NE¼ Sec. 3, T10N, R3W. Drilled October 7, 1938.

Elevation: 150 feet.

Thickness	Depth (feet)	Samples	Description (after Mellen, 1940)
	6.2 (top)		**Yazoo formation**
14.2	20.4	5B (C-1 of MGS)	Clay, plastic, silty, calcareous, gypsiferous, light-gray in upper part; lime nodules in upper part; marine fossils throughout; grades into bluish-gray at 12.6′.
8.6	49.0	5A (C-4 of MGS)	Clay, plastic, tough, silty, calcareous, non-gypsiferous, bluish-gray; marine fossils.
49.0	TD		Abandoned while in same type material.

Locality Six: Test Hole Record C-8 of Mississippi Geological Survey. See Mellen, 1940, p. 54.

Location: Seward property (in 1938) in Yazoo County, Mississippi; approximately 23 yards N of Zelleria Station; in N½ SW¼, Sec. 19, T13N, R1W. Drilled September 14, 1938.

Elevation: 230 feet.

Thickness	Depth (feet)	Samples	Description (after Mellen, 1940)
8.8	(top)		**Yazoo formation**
8.4	20.9	6B (C-2 of MGS)	Clay, semi-plastic, calcareous, light grayish-yellow.
8.9	30.6	6A (C-3 of MGS)	Clay, semi-plastic, light bluish-gray, calcareous, very silty; marine fossils.
	32.0		**Moodys Branch formation**

Locality Seven: Midway Structure, Test Hole 13.

Location: On Swayze property (in 1940) 20 feet W of center of county road; SW¼ NW¼ SE¼, Sec. 14, T12N, R1E, Yazoo County, Mississippi.

Elevation:

Depth (feet)	Sample	Description
Top near surface		**Yazoo formation**
15.2 - 36.2	7A (washed sample provided by Frederic F. Mellen)	Washed material is gray in color with abundant Foraminifera, Ostracoda and glauconite in the form of fecal pellets and foraminiferal casts, fragments of megafossils and calcareous lumps. There are a few ferruginous stained sand grains.

Locality Eight: Test Hole AF-40 Cored Section of Mississippi Geological, Economic and Topographical Survey. See Moore, 1965, p. 132.

Location: Twenty-five feet north of east-west gravel road in SW¼ SE¼ NW¼, Sec. 5, T7N, R1W, Hinds County, Mississippi.

Elevation: 275 feet (from topographic map).

Thickness	Depth (feet)	Sample	Description (after William H. Moore)
	8.0 (top)		**Upper Yazoo formation**
15.5	42.0	8A	Clay, blue-green, calcareous, rare fossils.

Locality Nine: Jackson Ready-Mix Concrete Auger Hole No. 1.

Location: Under the kiln at the Jackson Ready-Mix Concrete Lightweight Aggregate Plant in Sec. 36, T7N, R1W, Hinds County Mississippi.

Elevation:

Depth (feet)	Samples	Description
		Yazoo formation
34.0 - 36.0	9E	Clay, grayish-green, calcareous, gypsiferous, slightly glauconitic, fossiliferous.
44.0 - 46.0	9D	Clay, grayish-green, calcareous, slightly gypsiferous, fossiliferous.
50.0	9C	Clay, grayish-green, calcareous. fossiliferous.
52.0 - 54.0	9B	Clay, grayish-green, calcareous, fossiliferous.
58.0 - 59.0	9A	Clay, grayish-green, calcareous, slightly glauconitic, very fossiliferous.

Locality Ten: Original Type Section of the Moodys Branch Formation.

Location: Approximately 100 yards SE of junction of Poplar Boulevard and Hazel Street in the city of Jackson, Mississippi.

Elevation: 276.5 feet.

Thickness Feet	Feet	Samples	Description (after Monroe 1954)
18.0			**Transition zone of Moodys Branch and Yazoo clay formation.**
	18.0	10B (collected by R. W. Barker from the lower part of the zone near the greensand unit below)	Clay, light yellow to cream colored, calcareous with mollusk impressions, slightly glauconitic and plastic in upper part and gradational with beds below.
13.0			**Moodys Branch formation**
	13.0	10A (collected by Karl Young and provided to the author by Dr. Henry V. Howe)	Sand, yellow to gray, clayey, glauconitic, fossiliferous with calcareous nodules six feet above base and reworked clay pebbles in basal one foot.
276.5 alt.			Unconformity

Remarks: Sample 10B is considered to be from the upper marl member and sample 10A is from the greensand member.

Locality Eleven: Test Hole AF-17, Stratigraphic Test of the Alternate Type Locality of the Moodys Branch Formation.

Location: In Riverside Park, city of Jackson, 400 feet south of "fossil gulch"; 800 feet from W line and 750 feet from N line of Sec. 36, T6N, R1E, Hinds County, Mississippi.

Elevation: 340 feet (from topographic map).

Thickness	Depth (feet)	Samples	Description (after William H. Moore, 1965, p. 122.)
35.0	9.0 (top)		**Yazoo formation**
	10.0 - 20.0	11H	Clay, light-green to yellow, mottled with limonite and manganiferous streaks in upper part. Clay, tan to pale-green calcareous, gypsiferous, very fossiliferous in lower part.
	20.0 - 30.0	11G	Clay, tan, mottled with blue-gray, calcareous, fossiliferous.
	30.0 - 40.0	11F	Clay, gray to gray-green in upper part, blue-gray in lower part, calcareous, fossiliferous, some pyrite.
6.0	44.0 (approx. top)		**Moodys Branch formation upper marl member**
	44.0 - 47.0	11E	Sand, green, fine-grained, clayey, fossiliferous, glauconitic, limey.
13.0	50 (approx. top)		**Greensand member**
	50.0 - 53.0	11C	Sand, green, fine-to-medium grained, very fossiliferous, very glauconitic, very limey.
	53.0 - 56.0	11B	Sand, green, to medium grained, very fossiliferous, very glauconitic, very limey.
	56.0 - 58.0	11A	Sand, green, fine to medium grained, very fossiliferous, very glauconitic, very limey.
249.0	58.0 (top)		**Cockfield formation**

Locality Twelve: Surface Outcrop of Alternate Type Locality of the Moodys Branch Formation.

Location: In a gulley called "fossil gulch" at the eastern edge of Riverside Park and approximately 1.5 miles east of the Bailey Junior High School in Jackson, Mississippi.

Elevation:

Thickness	Depth	Samples	Description
(feet)	(feet)		
6.0			**Yazoo formation**
4.0			**Moodys Branch formation upper marl member.**

4.0	12E (collected approx. the middle of 4.0' unit)	Sands and marl, slightly indurated, grayish-green fresh, weathers gray to buff, glauconitic, argillaceous, fossiliferous.
13.0		**Greensand member**
3.0	12D (collected 3.0 feet below contact with marl unit above)	Sand, fine to medium grained, blue-green fresh, weathers gray, very glauconitic, very fossiliferous.
4.0	12C (collected 4.0 feet below 12D above)	Sand, fine to medium grained, blue-green, weathers gray, very glauconitic calcareous, highly fossiliferous.
4.0	12B (collected 4.0 feet below 12C above)	Sand, fine to medium grained, dark blue-green, very glauconitic, calcareous, very fossiliferous.
1.0	12A (collected 1 foot below 12B above and 1 foot above Transition zone below)	Sand, fine to medius grained, dark blue-green, very glauconitic, calcareous, very fossiliferous.
1.0		Sand, fine to medium grained, dark blue-green, very glauconitic, calcareous, very fossiliferous.
3.0		**Transition zone of Cockfield and Moodys Branch formations.**
3.0		Sand, fine to medium grained, intercalated with clays, dark gray-green, very glauconitic, lignitic with reworked material from below.
Elev. (?)	Bottom of gulch	**Cockfield formation**

Remarks: In addition to the samples shown above, three additional samples from this section which were collected by the geology staff at Mississippi State University were used in this study. These samples were all collected from the lower and middle part of the greensand member.

Locality Thirteen: Test Hole AG-39A of Mississippi Geological Economic and Topographical Survey. Drilled September 25, 1969.

Location: Alongside log road behind Rufus King house and barn: adjacent to Hole AG-39; N/2 SE/4 NW/4, Sec. 17, T6N, R5E, Rankin County, Mississippi.

Elevation: 399.0 feet (from barometer)

Thickness	Depth	Samples	Description (after Wilbur T. Baughman)
			Middle Yazoo formation
2.0	2.0		Soil, silty.
8.0	10.0		Silt, yellow, mottled, clayey, occasional coarse sand, occasional pebbles.
4.0	14.0		Silt, tan-yellow mottled, clayey.
5.0	19.0	13D	Clay, tan, greenish-tan mottled, manganiferous streaks, slightly gypsiferous, calcareous in part, bentonitic, plastic.
5.0	24.0	13C	Clay, greenish-tan, manganiferous streaks. slightly gypsiferous, calcareous, plastic, limonitic streaks, occasional limonite nodule.
6.0	30.0	13B	Clay, greenish-tan, slightly silty, sparingly manganiferous, slightly gypsiferous, calcareous, limonitic streaks, iron concretions.
4.0	34.0	13A	Clay, gray, silty partings, fossiliferous, calcareous, plastic.

Locality Fourteen: Test Hole AG-40 of Mississippi Geological Economic and Topographical Survey. Drilled September 25, 1969.

Location: Approximately 190.0 feet north of black top country road in north edge of pine grove; NW/4 SE/4 SE/4, Sec. 7, T5N, R5E, Rankin County, Mississippi.

Elevation: 400.0 feet (from topo map).

Thickness	Depth	Samples	Description (after Wilbur T. Baughman)
			Upper Yazoo formation
2.0	2.0		Soil, silty, clayey.
6.0	8.0		Silt, tan to buff with red and light gray streaks, occasional pebbles.
2.0	10.0		Silt, fine sand with silt, buff to light gray with yellow tan streaks, slightly micaceous.
1.0	11.0	14C (from a zone 11.0′ to 16.0′ in depth)	Clay, silty streaks, gray to tan with yellow-brown streaks, calcareous.
14.0	25.0		Clay, tan, greenish-tan, gypsiferous, slightly silty, fossiliferous, silty partings, calcareous.
2.0	27.0	14B (from a zone 21.0′ to 26.0′ in depth)	Clay. tan, green-tan, gray-green streaks, gypsiferous, fossiliferous, calcareous.
1.0	28.0		Clay, gray-green, slightly fossiliferous, calcareous.
1.0	29.0		Clay, tan, fossiliferous, gypsiferous, calcareous, pyritiferous.
5.0	34.0	14A (from a zone 30.0′ to 34.0′ in depth)	Clay, green, gray-green, fossiliferous, calcareous.

Locality Fifteen: Core Hole LWA-20 of Mississippi Geological Economic and Topographical Survey. Drilled March 4, 1964.

Location: In pasture approximately 50.0 feet southwest of a segment of old U. S. Highway 80 and 0.5 miles northeast of U. S. Highway 80; about 1.7 air miles northeast of Pelahatchie; center SW/4 SE/4, Sec. 26, T6N, R5E, Rankin County, Mississippi.

Elevation: 444.0 feet (from topo map).

Thickness	Depth	Samples	Description
			Terrace deposits
12.0	12.0		Silt, light gray to tan, slightly sandy, argillaceous.
10.0	22.0		Sand, red-brown to orange-red, medium to coarse-grained; contains some streaks of light-gray mottled pink clay; stained with iron oxide.
			Yazoo formation
40.0	62.0	15A (composite of material from 40.0 to 62.0 feet depth)	Clay, green-gray to gray-green, slightly silty in part, calcareous, fossiliferous.

Locality Sixteen: Test Hole J-86 of Mississippi Geological Survey. See Bergquist, 1942, p. 90.

Location: On U. S. Government property thirty feet west of road at a point ¼ mile south of Forkville Fire Tower; NW¼ NW¼ NW¼, Sec. 25, T8N, R6E in Scott County, Mississippi. Drilled October 9, 14-16, 1940.

Elevation: 386 feet.

Thickness	Depth	Samples	Description (after Bergquist, 1942)
	Top near surface		**Lower Yazoo clay**
13.8	24.3	16B (P-4 of MGS)	Clay, calcareous, grayish-tan, minor brown streaks, chalky lime in upper 2 feet; lower 6 feet of a uniform color grading into unweathered bed below. Foraminifera and Ostracoda abundant.
25.2	49.5	16A (P-5 of MGS)	Clay, tough, smooth, calcareous, greenish-gray, streaks of fine granular marcasite, abundant Foraminifera and Ostracoda, some glauconite in lowest 2 feet.
70.0 feet estimated depth to top of			**Yegua (Cockfield) formation**

Locality Seventeen: Test Hole J-89 of Mississippi Geological Survey. See Bergquist, 1942, p. 92.

Location: On the R. C. Baker property (in 1940) at a point on the slope north of the barn, 75 yards northwest of the house, and 20 feet east of the fence; in NE¼ SE¼ NE¼, Sec. 23, T7N, R6E, Scott County, Mississippi. Drilled October 14 and 16, 1940.

Elevation: 385 feet.

Thickness	Depth	Samples	Description (modified from Bergquist, 1942)
	Surface		**Yazoo clay basal part**
6.2	6.2	17C (P-1 of MGS)	Clay, calcareous, light tan, minor streaks of iron oxide; abundant Foraminifera and Ostracoda.
27.3	33.5	17B (P-2 of MGS)	Clay, calcareous, greenish-gray, tan streaks in upper 6 feet; crumbly and highly fossiliferous (abundant Foraminifera, Ostracoda and small mollusk shells).
5.0	38.5	17A (P-3 of MGS) (This sample is considered to be from the Moodys Branch upper marl member in this paper.)	Clay, greenish-gray, plastic, calcareous, very fossiliferous. Lower two feet very glauconitic.

Locality Eighteen: Test Hole J-27 of the Mississippi Geological Survey. See Bergquist, 1942, p. 87.

Location: On U. S. Government property beside a fence on north side of roadcut, 100 yards east of road corner; in SW¼ SE¼ SE¼, Sec. 15, T5N, R6E, Scott County, Mississippi. Drilled June 28, 1940.

Elevation: 417 feet.

Thickness	Depth	Sample	Description (after Bergquist, 1942)
	12.4 (top)		**Yazoo clay upper beds**
12.6	25.0	18A (P-2 of MGS)	Clay, greenish-gray, calcareous; upper 2 feet weathered tan; contains abundant Foraminifera and Ostracoda and mollusk shell fragments.

Locality Nineteen: Test Hole J-91 of Mississippi Geological Survey. See Bergquist, 1942, p. 92.

Location: On the Will Miles property (in 1940) in a gulley north of the road on a west-facing hillside one-fourth mile east of Robinson Creek; SW¼ NW¼ SW¼, Sec. 16, T5N, R7E, Scott County, Mississippi. Drilled October 22, 1940.

Elevation: 418 feet.

Thickness	Depth	Sample	Description (after Bergquist, 1942)
	4.5 (top)		**Yazoo clay upper beds**
6.0	34.8	19A (C-3 of MGS)	Clay, calcareous, smooth, unweathered greenish-gray; contains abundant Foraminifera and mollusk shells.

Locality Twenty: Stratigraphic Test at Type Locality of the North Twistwood Creek Clay Member.

Location: Edge of woods at top of hill about 85 feet from NW of center line of Mississippi Highway 18, SW of Rose Hill, Mississippi; in NE¼ NE¼ NE¼, Sec. 11, T2N, R12E, Jasper County, Mississippi. Drilled July 23, 1964.

Elevation: 425 feet.

Depth	Samples	Description (after William H. Moore)
Top (near surface)		**Pachuta marl member**
10.0 - 11.5	20H	Limestone, tan, stained with yellow, very silty, sandy, glauconitic, fossiliferous, marl in part.
17.0 (approx. top)		**North Twistwood Creek clay member**
20.0 - 21.5	20G	Clay, gray-green, calcareous, glauconitic, fosiliferous, finely micaceous, very glauconitic and fossiliferous in lower 6 inches. Some phosphatic fossil material.
30.0 - 31.5	20F	Clay, gray-green, calcareous, fossiliferous, finely micaceous, glauconitic in upper 6 inches.
40.0 - 41.5	20E	Clay, gray-green, calcareous, fossiliferous, more fossiliferous and glauconitic in lower foot.
50.0 - 51.5	20D	Clay, gray-green, calcareous, fossiliferous, glauconitic in part, finely micaceous.
60.0 - 61.5	20C	Clay, green, calcareous, slightly fossiliferous to fossiliferous in lower 6 inches.
64 (approx. top)		**Moodys Branch formation**
70.0 - 71.5	20B	Marl, green, very sandy, very fossiliferous, very glauconitic, limey sand in part, iron stained in part.
80.0 - 81.5	20A	Marl, green, very sandy, very fossiliferous, very glauconitic.
88.0		**Cockfield formation**

Remarks: Only one sample from the surface outcrop of the North Twistwood Creek clay member in this area was used in this study. This sample was collected by Dr. Grover Murray and designated

as sample #205, Louisiana State University, Museum of Geology. It was collected a few feet below the top of the North Twistwood Creek clay member.

Locality Twenty-One: Test Hole LWA-10 of Mississippi Geological Economic and Topographical Survey.

Location: Approximately 35 feet east of center line of U. S. Highway 11 about 3.35 miles northeast of Stafford Springs Lodge; NW¼ of NW¼, Sec. 7, T1N, R14E, Clarke County, Mississippi. Drilled January 15, 1964.

Elevation: 359.0 feet (from topo map).

Depth	Sample	Description
Top near surface		**Shubuta clay member**
30.0 - 62.0	21A	Clay, greenish-gray fresh, weathers gray to buff, blocky, calcareous, very fossiliferous. Abandoned while still in Shubuta clay.

Locality Twenty-Two: Stratigraphic Test near Type Locality of the Pachuta Marl Member.

Location: In a pine grove about 75 feet east of the center line of U. S. Highway 11 and 90 feet north of the center line of a road east and south of a church at Barnett; in the SW¼ of NE¼, Sec. 30, T2N, R14E, Clarke County, Mississippi. Drilled July 23, 1964.

Elevation: 330 feet (from topo map).

Depth	Samples	Description (modified from William H. Moore)
		Pachuta marl member
8.0 - 11.5	22L	Clay, gray-green, very limey, very fossiliferous, lime nodules, tan marl in part, glauconitic in lower foot.
12.0 - 13.0	22K	Marl, cream to tan, glauconitic, fossiliferous, soft limestone in part, sandy in part.
13.0 - 14.0	22J	Marl, cream to tan, glauconitic, fossiliferous, soft limestone in part, sandy in part.
15.0 - 16.0	22I	Limestone, cream, soft, some glauconite, fossiliferous, sandy.
16.0 - 20.0	22H (from a zone 19.0'-20.0' in depth)	Marl, cream to tan, glauconitic, fossiliferous, soft limestone in part, sandy, clayey in part.
20.0 - 22.5	22G	Marl, cream to tan, very glauconitic in part, very sandy, fossiliferous, very clayey in lower 6 inches.

		North Twistwood Creek clay member
22.5 - 25.0		Clay, tan to gray, fossiliferous and calcareous, finely micaceous, few sand grains.
25.0 - 27.0		Clay, gray mottled with yellow, fossiliferous, calcareous, finely micaceous.
27.0 - 35.0	22F	Clay, gray to gray-green, fossiliferous, calcareous, sandy, glauconitic, finely micaceous.
35.0 39.0		Clay, gray, very fossiliferous. some phosphatic material.
39.0 - 41.5		Clay, gray-green, fossiliferous, calcareous.
41.5 - 62.5	22E (from a depth of 59.0'-60.0')	Clay, gray-green, fossiliferous with very limey streaks and concentrations of macrofossils.
62.5 - 70.5		Clay, green to dark green, calcareous, fossiliferous.
79.0 - 80.0	22D	Clay, gray-green, limey, fossiliferous, very limey in part.
		Moodys Branch formation upper marl member
81.0 - 82.0	22C	Clay, green, glauconitic, fossiliferous, sandy, green sandy marl in part.
		Greensand member
86.0 - 87.0	22B	Sand, green, very glauconitic, fossiliferous, very argillaceous, sandy marl in part.
94.0 - 95.0	22A	Green, fine-grained sand, very glauconitic, very fossiliferous, stained with iron in part, (sideritic) some inclusions of gray clay and lignite.

Locality Twenty-Three: Pachuta Creek Outcrop.

Location: Samples were collected along the south bank of Pachuta Creek beginning at a point approximately 0.5 mile downstream and east of the U. S. Highway 11 bridge over Pachuta Creek south of Pachuta, Mississippi, at corporate limits; in SW¼, Sec. 3, T10N, R16E, Clarke County, Mississippi.

Thickness Feet	Feet	Samples	Description
5.0	(variable)		Soil and vegetal matter.
15.0	variable exposed above water level of Pachuta Creek		**North Twistwood Creek clay member**
	5.0 approx.	23E (collected from south bank 10 feet above water level of creek)	Clay, grayish-green fresh, weathers gray, calcareous, micaceous, slightly glauconitic, fossiliferous.

7.0	23D (collected approx. 7 feet below 23E and 3 feet above edge of water in creek channel)	Clay, grayish-green fresh, weathers gray, calcareous, micaceous, slightly glauconitic, fossiliferous but slightly weathered.
3.0	23A, 23B, 23C (all were collected at edge of water of channel of Pachuta Creek.	Clay, grayish-green fresh, weathers gray, micaceous, calcareous, slightly glauconitic, fossiliferous.
	23A was collected at edge of water on south bank a few yards downstream from a large meander. 23B was collected a few yards upstream from 23A and 23C was collected at water's edge approximately 100 yards east of and downstream from U. S. Highway 11 bridge over Pachuta Creek. This one is probably 2 feet higher stratigraphically than 23A.	

Elevation: (?) Edge of water of channel of Pachuta Creek.

Locality Twenty-four: Moodys Branch Formation Section of Garland Creek. Locality JGC of Shreveport Geological Society.

Location: On south bank of Garland Creek approximately 0.2 mile upstream from a bridge over the creek. The bridge is in a private

pasture and is approximately 4.7 miles NE, by road, of an artesian well (at the intersection of Eucutta Street and the G. M. & O. R.R.) in Shubuta, Mississippi. It is located in the NW¼ NW¼, Sec. 28, T1N, R1E, Clarke County, Mississippi.

Elevation:

Thickness Feet	Feet	Samples	Description
(8.0 total thickness)			**Moodys Branch formation**
2.0			**Upper marl member**
	0.5	24F (collected at top of sand near contact with North Twistwood Creek clay)	Sand, fine to medium grained, dark blue-green fresh, weathers gray, glauconitic and very fossiliferous.
	1.5	24E (collected 1.5 feet below 24F above)	Sand, fine to medium grained, dark blue-green fresh, weathers gray, glauconitic and very fossiliferous.
6.0			**Greensand member**
	2.5	24D (collected 2.5 feet below 24E above)	Sand, fine to medium grained, dark blue-green fresh, weathers gray, glauconitic, very fossiliferous.
	3.5	24C (collected 3.5 feet below 24D above)	Sand, fine to medium grained, dark blue-green fresh, weathers gray, glauconitic, very fossiliferous.
14.5			**Transition zone of Moodys Branch and Cockfield formation**
	2.5		Shale, dark gray fresh, weathers reddish brown, with small layers of marl interbedded.
	3.0	24B (collected 3 feet below shale member described above)	Sand, fine to medium grained, dark green fresh, has 6″ to 8″ weathered surface reddish-brown in color, flakes off in slabs, very argillaceous, silty, lignitic, slightly glauconitic.
	4.0	24A (collected 4 feet below 24B above and 5 feet above Cockfield formation below)	Sand, fine to medium grained, dark green fresh, has 6″ to 8″ weathered surface reddish-brown in color, flakes off in slabs, very argillaceous, silty, lignitic, slightly glauconitic.
	5.0		Sand, fine to medium grained, dark green fresh, has 6″ to 8″ weathered surface reddish-brown in color, flakes off in slabs, very argillaceous, silty, lignitic, slightly glauconitic.

7.0			**Cockfield formation**
	0.5		Sand, fine to medium grained, red, ferruginous, indurated, forms ledge.
	6.5		Sand, fine to medium grained, intercalated with shales, gray fresh, weathers red to chocolate color, lignitic, silty.

Elev. (?) Edge of water in channel of Garland Creek

Remarks: The Museum of Geology, Louisiana State University, provided the writer with two additional samples from this section. They were collected from the greensand member.

Locality Twenty-Five: On Garland Creek near Chickasawhay River.

Location: In a large meander of Garland Creek at the edge of an old field approximately 0.9 mile northeast of the "Hanging Bridge" over Chickasawhay River; in Sec. 29, T1N, R16E, Clarke County, Mississippi.

Thickness Feet	Samples Feet		Description
20.0 (approx. exposed above water level of creek)			**North Twistwood Creek clay member lower part.**
	5.0	25B (collected 15 feet above edge of water of channel in the south band of creek near a large meander)	Clay, dark grayish-green fresh, weathers gray, micaceous, glauconitic, calcareous, fossiliferous.
	15.0 approx.	25A (collected near edge of channel of Garland Creek)	Clay, dark grayish-green fresh, weathers gray, micaceous, glauconitic, calcareous, fossiliferous.

Elev. (?) Edge of water of channel of Garland Creek.

Locality Twenty-Six: Type Section of Shubuta Clay Member.

Location: A large gulley which begins at the water's edge of Chickasawhay River just under the north side of the old U. S. Highway 45 bridge over Chickasawhay River and extends eastward for 1300.0 feet up a large hill and approximately along the north line of the NW¼ of Sec. 10, T10N, R7W, Clarke County, Mississippi.

Elevation: 263.0 feet at top of hill.

Thickness Feet	Thickness Feet	Samples	Description
10.0 (?) Estimated only. All of the Red Bluff formation under cover.			**Red Bluff formation**
	10.0		Cover
86.0 (?) Estimated only. Upper contact is under cover. 62.0′ exposed.			**Shubuta clay member.**
	24.0	26H (collected by E. H. Rainwater 15.0′ below base of Red Bluff when this part of the section was exposed)	Cover
	1.0		Clay, dark grayish-green fresh, weathers buff, blocky, calcareous, lime nodules scattered about, fossiliferous.
	15.0	26G (collected approx. 15.0′ above 26F below and 1.0′ below cover zone)	Clay, dark grayish-green fresh, weathers gray to buff, blocky, calcareous, lime nodules scattered about over surface, fossiliferous.
	20.0	26F (collected approx. 20.0′ above 26E below)	Clay, dark grayish-green fresh, weathers gray to buff, blocky, plastic calcareous, fossiliferous.
	15.0	26E (collected approx. 15.0′ above 26C below)	Clay, grayish-green fresh, weathers gray to buff, plastic, blocky, calcareous, fossiliferous.
	10.0	26D (collected approx. 10.0′ above 26C below)	Clay, grayish-green fresh, weathers gray to buff, plastic, blocky, calcareous, fossiliferous.
	1.0	26C (collected approx. 1.0′ above contact with Pachuta marl)	Clay, grayish-green fresh, weathers gray to buff, plastic, blocky, calcareous, fossiliferous.
12.0			**Pachuta marl member**
	5.5	26B (collected from approx. 4.0′ below contact with Shubuta clay)	Marl, semi-indurated, gray to ivory, very sandy, glauconitic, abundant **Pecten** and bryozoan casts. Marl forms terrace at contact with Shubuta clay.

	$26B_1$, $26B_2$ also collected from within this unit.	
2.5		Marl, indurated, gray to ivory, very sandy and glauconitic.
2.0		Marl, indurated, very sandy, glauconitic with echinoids. Forms prominent ledge.
1.0		Marl, indurated, very sandy, glauconitic. Forms prominent ledge.
1.0		Marl, indurated, very sandy, glauconitic. Forms prominent ledge.
10.0 to edge of river channel		**Cocoa sand member**
7.0		Cover, badly slumped.
3.0	26A (collected from edge of water of channel of Chickasawhay River) $26A_1$, also collected from this unit.	Sand, fine-grained, dark bluish-green fresh, weathers gray to reddish brown, argillaceous.

145.0 elevation — Edge of water of channel of Chickasawhay River; still in Cocoa sand.

Remarks: Samples $26A_1$, $26B_2$ and 26H were collected from this section by Mr. E. H. Rainwater several years ago when the section was better exposed. Sample $26B_1$ was collected by Dr. Alan Cheetham and provided to the writer by the Louisiana State University Museum of Geology. Three additional samples which were collected from this section many years ago by the geology staff at Mississippi State University were also used in this study. The exact stratigraphic position of these samples is not absolutely certain but they are considered to be from the lower part of the upper half of the Shubuta clay.

Locality Twenty-Seven: Red Bluff Formation on Chickasawhay River.

Location: On east bank of Chickasawhay River approximately one mile SW of Post Office at Hiwannee, Mississippi; in SW¼, T10N. R7W, Wayne County, Mississippi.

Elevation:

Thickness Feet	Feet	Samples	Description
			Top of Bluff
	4.0		Soil and vegetal matter

18.5			**Red Bluff formation**
3.0	exposed above edge of water of channel of Chickasawhay River.		**Shubuta clay member**
	3.0	27A	Clay, grayish-green, weathers buff, blocky, calcareous, plastic, fossiliferous.

Elev. (?) Edge of water of channel of Chickasawhay River. In Shubuta clay.

Locality Twenty-Eight: Shiloh Creek Bridge Section.

Location: South bank of Shiloh Creek near the Mathersville-Frost Bridge dirt road bridge over Shiloh Creek. Approximately 3.5 miles NW of Frost Bridge; in SW¼, Sec. 18, T10N, R5W, Wayne County, Mississippi.

Elevation:

Thickness Feet	Feet	Samples	Description
13.0	feet to top of bluff		**Cocoa sand member**
	9.0		Sands, red to yellow, silty, colluviated and badly weathered, (partly under cover).
	4.0		Covered by slump.
11			**North Twistwood Creek clay member**
	1.0		Claystone ledge
	3.0	28C (collected by Gene Martin 3 feet below the above claystone ledge)	Clay, grayish-green fresh, weathers gray to buff, silty, calcareous, micaceous, fossiliferous with small bands of claystone concretions in lower part.
	5.0	28B (collected on bank 2 feet above 28A and 3 feet below 28C)	Clay, grayish-green fresh, weathers gray, blocky, gummy, fossiliferous.
	2.0	28A (collected at edge of water of channel of Shiloh Creek)	Clay, grayish-green fresh, weathers gray, blocky, gummy, fossiliferous.

Elev. (?) Edge of water of channel of Shiloh Creek. Channel is being cut in North Twistwood Creek clay.

Locality Twenty-Nine: Frost Bridge Road Y Locality.

Location: Between the forks of a Y on a dirt road approximately 0.5 mile west of Frost Bridge over Bucatunna Creek; in SW¼, Sec. 29, T10N, R5W, Wayne County, Mississippi.

Elevation:

Thickness Feet	Feet	Samples	Description
4.0			Soil and vegetal matter.
19.0			**Shubuta clay member.**
	19.0	29C (collected by geology staff of Mississippi State University from approximately the middle of the Shubuta clay section)	Clay, buff to tan, badly weathered and slumped, blocky, gummy, slightly fossiliferous, limestone concretions scattered about on surface.
12.0			**Pachuta marl member.**
	1.5		Limestone ledge, indurated, gray to white, weathers ivory, slabby, sandy and glauconitic.
	5.5	29B (collected from **Pecten**-bryozoan zone approximately 2.5 feet from top of Pachuta) $29B_1$ and $29B_2$ were also collected from this unit.	Marl, semi-indurated, gray to buff, weathers ivory, sandy, glauconitic. Abundant **Pecten** and bryozoan remains.
	4.5	29A (collected approximately 5 feet below 29B above)	Marl, semi-indurated, gray to buff, weathers ivory, sandy and glauconitic.
	0.5		Limestone ledge, indurated, gray to white, weathers ivory, sandy, glauconitic.
15.0 (approx. to ditch at road Y)			**Cocoa sand member.**
	3.0		Sand, fine to medium grained, white to ferruginous.
	12.0		Cover to bottom of ditch at road Y.
Elev. (?)			Bottom of ditch at road Y.

Remarks: Samples $29B_1$ and $29B_2$ were collected by Mr. Gene Martin of Gulf Oil Corp. and the Geology staff at Mississippi State University respectively.

Locality Thirty: Frost Bridge at Bucatunna Creek.

Location: Along the west bank of Bucatunna Creek from points approximately 150 to 350 yards upstream from bridge over Buckatunna Creek at Frost Bridge; in SW¼, Sec. 28, T10N,R5W. Wayne County, Mississippi.

Elevation:

Thickness Feet	Feet	Samples	Description
5.0			Soil and vegetal matter.
	5.0		Sand and clay, gray to brown, silty, badly slumped and weathered.
10.0			**North Twistwood Creek clay member**
	4.0	30D (collected approx. 4′ below top of member)	Clay, grayish-green fresh, weathers gray, slightly silty, micaceous, fossiliferous with claystone ledge 2 feet from top of member.
	1.0	30C (collected one foot below 30D above)	Clay, grayish-green fresh, weathers gray, slightly silty, micaceous, fossiliferous.
	2.0	30B (collected approx. 2′ below 30C above and 3′ above 30A below)	Clay, grayish-green fresh, weathers gray, slightly silty, micaceous, fossiliferous with claystone ledge in upper part.
	3.0	30A (collected at edge of water of channel of Bucatunna Creek)	Clay, grayish-green fresh, weathers gray, blocky, micaceous, fossiliferous.
Elev. (?)			Edge of water of channel of Bucatunna Creek. Channel is being cut in the North Twistwood Creek clay.

Locality Thirty-One: Keyser Hill, Alabama

Location: On south bank of a large roadcut on Choctaw County Road 14, 6.0 miles west of Gilbertown, Alabama, in SW¼, Sec. 20, T11N, R4W, Choctaw County, Alabama.

Elevation:

Thickness Feet	Feet	Samples	Description
6.0 - 8.0 (variable)			(?) Terrace sands and soil
	6.0 - 8.0		Sand, fine-to medium grained, colluviated, red to brown.

26.0 (estimated)		**Cocoa sand member**
2.0		Sand, fine grained, colluviated, white to buff.
1.0	31H (collected 3.0′ above 31G below and 1.0′ below colluviated sand)	Sand, fine-grained, bluish-green fresh, weathers gray to buff, massive, argillaceous, micaceous, fossiliferous.
3.0	31G (collected 3.0′ above 31F below)	Sand, fine - grained, bluish - green fresh, weathers gray to buff, massive, argillaceous, micaceous, fossiliferous.
3.0	31F (collected 2.0′ above 31E below)	Sand, fine - grained, bluish - green fresh, weathers gray to buff, massive, argillaceous, micaceous, fossiliferous.
2.0	31E (collected 3.0′ above 31D below)	Sand, fine - grained, bluish - green fresh, weathers gray to buff, massive, argillaceous, micaceous, fossiliferous.
3.0	31D (collected 3.0′ above 31C below)	Sand, fine - grained, bluish - green fresh, weathers gray to buff, massive, argillaceous, micaceous, fossiliferous.
3.0	31C (collected 1.0′ above colluviated sand below)	Sand, fine - grained, bluish - green fresh, weathers gray to buff, massive, argillaceous, micaceous, fossiliferous.
1.0		Sand, fine - grained, bluish - green fresh, weathers gray to buff, massive, argillaceous, micaceous, fossiliferous.
4.0		Sand, fine - grained, buff to brown, silty, colluviated, badly weathered.
4.0		Cover.
41.0 estimated. Contact gradational and under cover.		**North Twistwood Creek clay member.**
9.0	31B (collected by Paul Krutak 31.0′ above the bridge before this part was covered)	Cover
4.5		Cover
6.5		Clay, grayish - green fresh, weathers gray, blocky, silty, micaceous, and slightly fossiliferous.

8.0	31A (collected by Paul Krutak 21.0′ above bridge)	Clay, grayish - green fresh, weathers gray, blocky, silty, micaceous, and slightly fossiliferous.
13.0		Cover
Elev. (?)		Road level at west end of bridge on Choctaw County Road 14.

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PLATE 27

Index map of sample localities in the Jackson Group in Mississippi

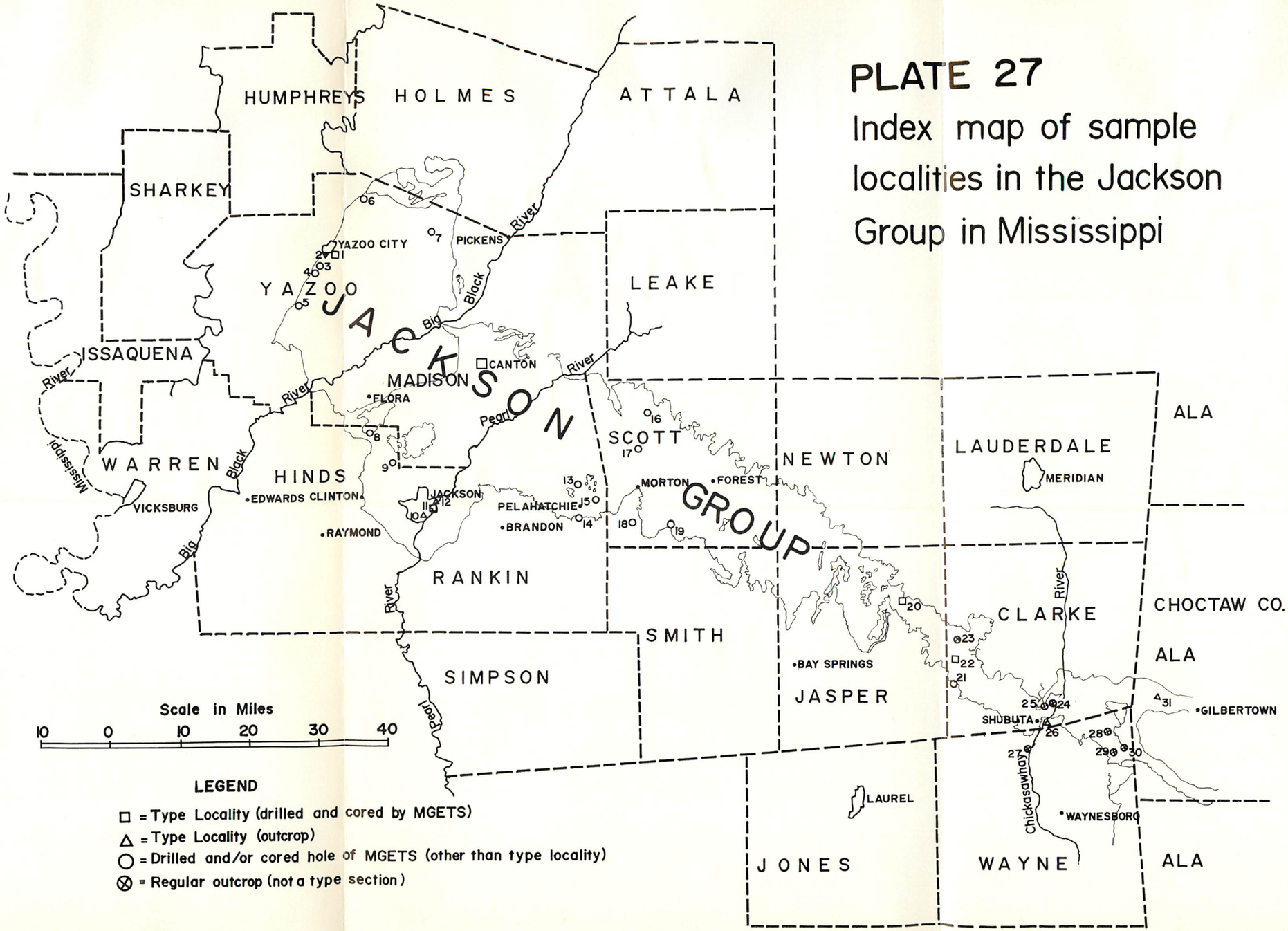

TABLE 2

SUMMARY OF STRATIGRAPHIC DISTRIBUTION OF OSTRACODA IN THE JACKSON GROUP OF MISSISSIPPI

NAME OF SPECIES	MOODYS BRANCH FORMATION		YAZOO FORMATION IN YAZOO, MADISON, RANKIN AND SCOTT COUNTIES		YAZOO FORMATION IN JASPER, CLARKE AND WAYNE COUNTIES					
					NORTH TWIST-WOOD CREEK CLAY		COCOA SAND	PACHUTA MARL	SHUBUTA CLAY	
	GREEN-SAND	UPPER MARL	LOWER BEDS	UPPER BEDS	LOWER HALF	UPPER HALF			LOWER HALF	UPPER HALF
Absonocytheropteron carinata Puri	R to A	R to C					R			
Absonocytheropteron watervalleyensis Krutak						C	R	R		VR
Acanthocythereis howei n. sp.				C				R	C to A	C to A
Actinocythereis boldi n. sp.	R to A	R to A	R to A	R to A	C	R to A	R to C	R to C	C	R to C
Actinocythereis gibsonensis (Howe and Chambers)	VR	R to C	R to C	R to A	R to C	C to A	C			
Actinocythereis grigsbyi (Howe and Chambers)			C to A	R to A			R to C			
Actinocythereis nodosa n. sp.	R to C	R to C	VR							
Actinocythereis puri n. sp.	VR	R	R to A	R to C				R to C	R to A	R
Acuticythere cocoaensis Krutak							R to C			
Alatacythere ivani Howe	VR	VR						VR	C	R
"Archicythereis" yazooensis (Howe and Chambers)	R to C	R to C	C	C	C	C to A	C	R to C	C to A	C to A
Argilloecia subovata n. sp.		VR	VR to R	R to C	C	C to A		R to C	R	R to C
Argilloecia sp.			VR							
Bairdia hiwaneensis Howe and Lea								VR to C	C	C
Bairdoppilata sp. (Howe and Chambers)	VR to C	(C)								
Basslerites sp.	VR						VR			
Brachycythere watervalleyensis Howe and Chambers	VR to A	C to A	C to A	R to A	R to C	C to A	C	R to A		(C)
Buntonia levinsoni n. sp.			VR		R	R		R	R to C	C to A
Buntonia morsei (Howe and Pyeatt)		R to C	C to A	R to A		R to C	R to C	R		
Buntonia shubutaensis Howe	R to C	C to A	C to A	R to A	R to A	R to A	C	C to A	R to C	C to A
Buntonia smithi n. sp.	VR	VR	R	R to C	VR	VR				C
Buntonia warneri (Howe and Pyeatt)	VR to R	R	R	R	R to C	C to A	R to C	R to C		R
Bythocypris (?) gibsonensis Howe and Chambers	VR to A	A	C to A	C to A	C to A	VR to C		C to A	A	C to A
Clithrocytheridea caldwellensis (Howe and Chambers)	C to A	R to A			R to A	R to C	R to C	VR to C		

TABLE 2 Continued

SUMMARY OF STRATIGRAPHIC DISTRIBUTION OF OSTRACODA IN THE JACKSON GROUP OF MISSISSIPPI

NAME OF SPECIES	MOODYS BRANCH FORMATION		YAZOO FORMATION IN YAZOO, MADISON, RANKIN AND SCOTT COUNTIES		YAZOO FORMATION IN JASPER, CLARKE AND WAYNE COUNTIES					
					NORTH TWISTWOOD CREEK CLAY		COCOA SAND	PACHUTA MARL	SHUBUTA CLAY	
	GREEN SAND	UPPER MARL	LOWER BEDS	UPPER BEDS	LOWER HALF	UPPER HALF			LOWER HALF	UPPER HALF
Clithrocytheridea garretti (Howe and Chambers)	R to A	R to A			R to C	R to C	C to A	R to A		
Clithrocytheridea grigsbyi (Howe and Chambers)	R to A	R to A	R		A	R to A	A	R to A		VR
Clithrocytheridea shubutensis (Stephenson)	R to C					VR	R to C			
Cushmanidea alta (Blake)	R to C	VR								
Cushmanidea gosportensis (Blake)	R to C									
Cushmanidea keyserensis Krutak						R	R to C	R		
Cushmanidea papula Krutak						VR to C	C to A	VR		
Cushmanidea serangodes Krutak							C			
Cushmanidea sp.							R			
Cyamocytheridea chambersi (Stephenson)	R to A	R to A			R to A	VR to A		R		
Cyamocytheridea hadleyi (Stephenson)	C to A	C				VR				
Cyamocytheridea watervalleyensis (Stephenson)	C to A	VR to C			R	R to C	C to A	R to C		
Cytherella hannai Howe and Lea								C to A	C to A	C to A
Cytherella sylverinica Howe and Law				R to C				C to A	R to A	R to A
Cytherella insculptilla n. sp			(C)	(C)					R	C
Cytherella sp. Howe and Chambers		R		R to C	C	R to A	R	R	(C)	
Cytherella undet. sp. A	R to A	R to A	R to A	C	R to A	R to A	R	R to C	C	R to A
Cytherella undet. sp. B	R to A	R to A	R to A	R to C		R?		R to C	C	
Cytherelloidea cocoaensis Krutak				C to A	R	R	R to C			
Cytherelloidea montgomeryensis Howe	R to A	R to A	R to A	R to C	R to A	R to A	R	R to C	R	
Cytherelloidea ouachitensis Howe			R to C	R to A						R
Cytheretta alexanderi Howe and Chambers	C to A	C to A	C to A	C to A	R	R to A	C to A	C to A		
Cytheromorpha asperata n. sp.			VR			R to C	VR to R	VR		
Cytheromorpha calva Krutak	R	VR	R to C		R to A	R to A	R to C	R		

TABLE 2 Continued

SUMMARY OF STRATIGRAPHIC DISTRIBUTION OF OSTRACODA IN THE JACKSON GROUP OF MISSISSIPPI

NAME OF SPECIES	MOODYS BRANCH FORMATION		YAZOO FORMATION IN YAZOO, MADISON, RANKIN AND SCOTT COUNTIES		YAZOO FORMATION IN JASPER, CLARKE AND WAYNE COUNTIES					
					NORTH TWIST – WOOD CREEK CLAY		COCOA SAND	PACHUTA MARL	SHUBUTA CLAY	
	GREEN – SAND	UPPER MARL	LOWER BEDS	UPPER BEDS	LOWER HALF	UPPER HALF			LOWER HALF	UPPER HALF
Cytheromorpha ouachitaensis Howe and Chambers			R to C	R		R to C	R	R		
Cytheropteron danvillensis Howe and Chambers	VR to R		VR	VR to C			VR	VR		VR
Cytheropteron lanceolata n. sp		R	VR		R	R to A	VR	R to C		
Cytheropteron montgomeryensis Howe and Chambers	C	C to A	C to A	R to A	C to A	R to A	C to A	C to A	C	C to A
Cytherura jacksoni n. sp.	VR to R									
Cytherura moorei n. sp.	VR to C					VR		VR		
Cytherura aff. C. ultra Blake	VR to R									
Digmocythere russelli (Howe and Lea)	C	R to C	R	(C)				C to A	A	C to A
Echinocythereis jacksonensis (Howe and Pyeatt)	C to A	C to A	C to A	C to A	R to A	R to C	R	A	C to A	C to A
Echinocythereis aff. E. nuda Puri			R			R		R	R to C	R
Eucythere lowei Howe	VR		VR	VR to R	VR to R	VR to R		C		VR
Eucythere aff. E. woodwardensis Howe								VR	VR	
Eucythere undet. sp. A								VR		
Eucythere undet. sp. B								VR		
Eucythere undet. sp. C	VR									
Haplocytheridea ehlersi (Howe and Stephenson)			R to A	C to A					R to C	R to A
Haplocytheridea montgomeryensis (Howe and Chambers)	C to A	A	C to A	C to A	A	A	A	C to A	C to A	C
Hazelina couleycreekensis (Gooch)						R		R to A	R	
Hemicythere bellula Howe	C									
Hemicythere (?) croneisi n. sp.	R to C	VR				R				
Henryhowella florienensis (Howe and Chambers)	C to A	A	C to A	C to A	R to A	C to A	C	A	A	A
Hermanites collei (Gooch)	R to C	(C)		VR	R	R to C	R	R		
Hermanites dohmi (Howe and Chambers)	R to C	R to A	R to A	R	R to C	R to A	R	R to A	A	C to A
Hermanites hysonensis (Howe and Chambers)	R to A	R to A	R to A		A	R to A	R to C	R to C		

TABLE 2 Continued

SUMMARY OF STRATIGRAPHIC DISTRIBUTION OF OSTRACODA IN THE JACKSON GROUP OF MISSISSIPPI

NAME OF SPECIES	MOODYS BRANCH FORMATION		YAZOO FORMATION IN YAZOO, MADISON, RANKIN AND SCOTT COUNTIES		YAZOO FORMATION IN JASPER, CLARKE AND WAYNE COUNTIES					
					NORTH TWIST–WOOD CREEK CLAY		COCOA SAND	PACHUTA MARL	SHUBUTA CLAY	
	GREEN–SAND	UPPER MARL	LOWER BEDS	UPPER BEDS	LOWER HALF	UPPER HALF			LOWER HALF	UPPER HALF
Hermanites melleni n. sp.	R to A						R	VR		
Hermanites moodysbranchensis n. sp.	R									
Hirsutocythere hornotina Howe	R to C									
Konarocythere spurgeonae (Howe and Chambers)	R to C	R to A	R		C to A	C to A	C to A	C		
Krithe hiwanneensis Howe and Lea								VR to R	R	R to C
Loxoconcha cocoaensis Krutak			R			R to A	R			
Loxoconcha concentrica Krutak	R to C	R to C	R to C	R to C	R to C	R to C	R to C	R	R	R to C
Loxoconcha creolensis Howe and Chambers	R to C	R to C				R to C	R	VR	R	VR to R
Loxoconcha inornata n. sp.	VR	VR to R	(A)	R	R to A	R to A	C	VR to R	VR	
Loxoconcha jacksonensis Howe and Chambers	R	R to A	R to A	R to C	R	R to C	R to C	R to C	R to C	R to A
Loxoconcha stavensis Blake	R to C					R				
Loxoconcha watervalleyensis Krutak					R	R to A	R to C			
Loxoconcha yazooensis n. sp.		VR	VR to C	R to C				VR		
Monoceratina alexanderi Howe and Chambers	R to A							R		
Monoceratina mucronata n. sp.			VR to R					VR	R	R
Monoceratina sp.			VR							
Murrayina sp.				VR					VR	
Occultocythereis broussardi (Howe and Chambers)	R to C	R to C	R			VR		R	R	R
Occultocythereis sp.								VR		
Opimocythere mississippiensis (Meyer)	R to A	R to C					R to C	R		
Paracypris franquesi Howe and Chambers	VR to C	VR to C	R to A	R to A	(C)	R to A	VR			
Paracypris licina n. sp.		C			C	C to A				
Paracytheridea belhavenensis Howe and Chambers	R to A	R to C			VR	R to C	R	R		
Phractocytheridea lirata n. sp.			R to A	R to A				R to C		VR?

TABLE 2 Continued

SUMMARY OF STRATIGRAPHIC DISTRIBUTION OF OSTRACODA IN THE JACKSON GROUP OF MISSISSIPPI

NAME OF SPECIES	MOODYS BRANCH FORMATION		YAZOO FORMATION IN YAZOO, MADISON, RANKIN AND SCOTT COUNTIES		YAZOO FORMATION IN JASPER, CLARKE AND WAYNE COUNTIES					
					NORTH TWIST – WOOD CREEK CLAY		COCOA SAND	PACHUTA MARL	SHUBUTA CLAY	
	GREEN – SAND	UPPER MARL	LOWER BEDS	UPPER BEDS	LOWER HALF	UPPER HALF			LOWER HALF	UPPER HALF
Phractocytheridea ouachitensis (Stephenson)			R to A	C to A				(C)	C to A	C to A
Pseudocytheromorpha sp.							VR			
Pterygocythere murrayi Hill								VR	C to A	
Trachyleberis montgomeryensis (Howe and Chambers)	R to C	C	C to A	R to A	R to C	R to C	C	C to A	A	A
Trachyleberis montgomeryensis bispinosa n. subsp.	R to C	A	C to A		R to A	R to A	C	R to C	C to A	C to A
Triginglymus hyperochus Blake	R						VR			
Triginglymus gnythophorous Krutak					R	R	C			
Triginglymus longicostata (Blake)	R									
Triginglymus sp.							R			
Tropidocythere carinata n. sp.	R to C	R to C			R	R	R	VR		
Xestoleberis sarsi Howe and Chambers	R to C	R to C			C	C to A	R	R to C	VR	VR

LEGEND

A = Abundant – more than 20 specimens per sample

C = Common – 7 – 20 specimens per sample

R = Rare – 3 – 6 specimens per sample

VR Very Rare – 1 – 2 specimens per sample

( ) = Occurs in only one locality of that stratigraphic unit