MISSISSIPPI
STATE GEOLOGICAL SURVEY

WILLIAM CLIFFORD MORSE, Ph.D.
Director

BULLETIN 49

SCOTT COUNTY

GEOLOGY
By
HARLAN RICHARD BERGQUIST, Ph.D.

TESTS
By
THOMAS EDWIN McCUTCHEON, B.S., Cer. Engr.

FOSSILS
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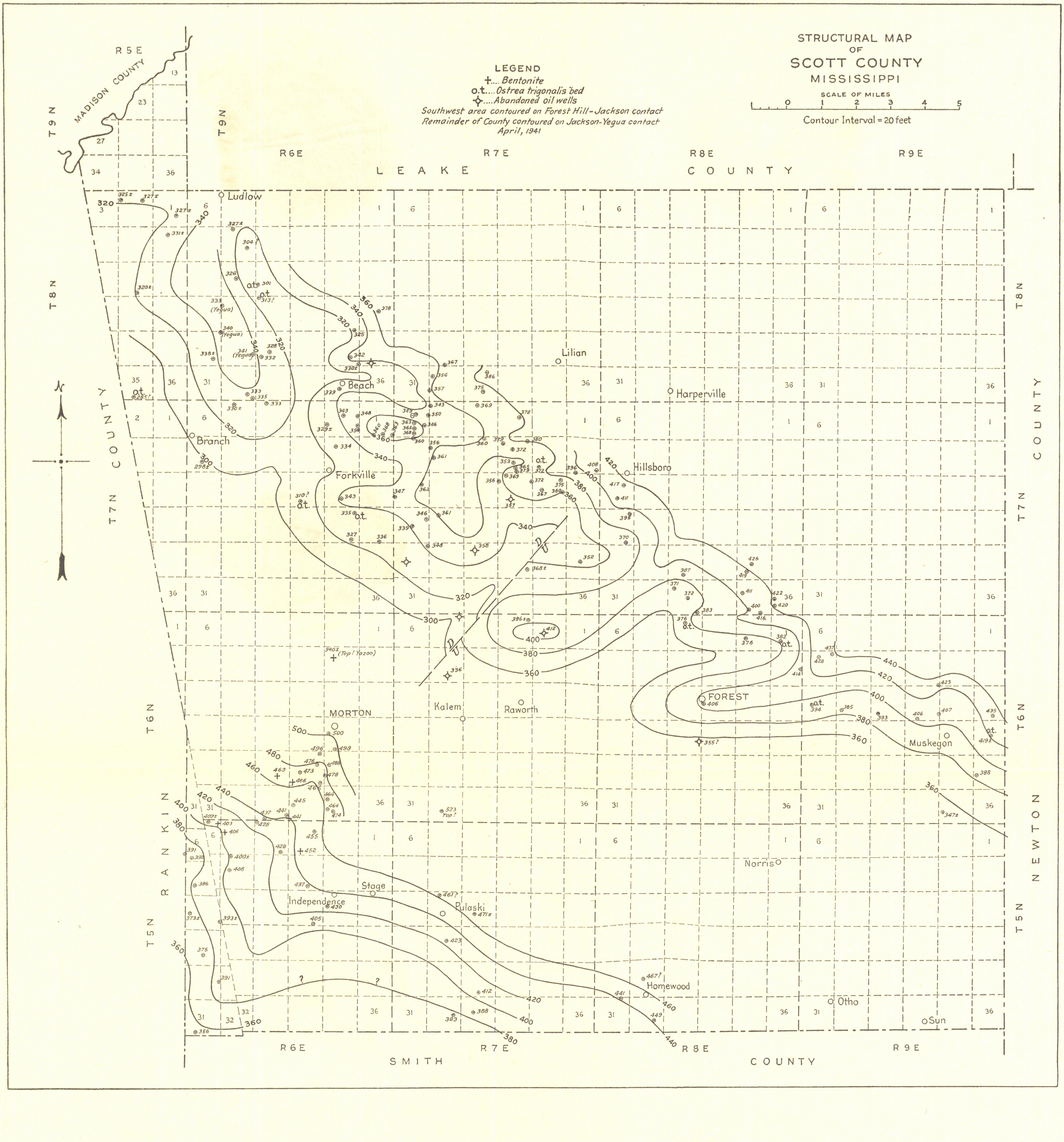
MAP 1



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Prepared in cooperation with the Scott County citizens and the WPA as a report on O.P. 65-1-62-137.

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MISSISSIPPI GEOLOGICAL SURVEY

LETTER OF TRANSMITTAL

Office of the Mississippi Geological Survey
University, Mississippi
August 24, 1942

To His Excellency,
Governor Paul Burney Johnson, Chairman, and
Members of the Geological Commission

Gentlemen:

Herewith is Bulletin 49, Scott County Geology, Tests, Fossils, which is published as a fulfillment in part of the sponsorship pledge of the Mississippi State Geological Survey, necessary to obtain Federal WPA funds for the various county geologic mineral surveys of the State.

In addition to the usual Geology part—by Harlan Richard Bergquist, Ph.D., and the Tests part—by Thomas Edwin McCutcheon, B.S., Cer. Engr., the bulletin contains a Fossils part by Dr. Bergquist—a marked departure from the previous county reports.

The Fossils part deals exclusively with the Jackson Foraminifera and Ostracoda, animals whose fossilized shells are so small that they are brought to the surface in test auger hole borings and oil well borings in great quantities and in a perfect state of preservation—a condition not possible with the larger fossils. By identifying and illustrating these microscopic forms and by determining their vertical range in or through the geologic formations, a task that only a comparatively few geologists are trained to perform, such a geologist is in a position intelligently to advise the oil well driller as to the age of the formation the drill is penetrating. Accordingly the Mississippi State Geological Survey is beginning the amassing of pure scientific information that will be of the utmost aid in the search for geologic structures favorable to the accumulation of oil and gas.

As this microscopic fossil work of the different formations continues in the various counties of the State, the Mississippi State Geological Survey will be in a better position to render a distinct service to those seeking to develop new oil fields in the state or to extend old fields—a service that it hopes to continue from this initiation of paleontologic study.

The Scott County report, as the other county reports, discloses a number of economic minerals, only a few of which can be mentioned here.

Under Structural Geology several structures that, as a class, are favorable for oil and gas accumulation are described even though the actual drill tests have, to date, produced neither. The geologic part shows the distribution of the clays of the county. The tests part reveals Scott County to have clays suitable for making high grade light-colored face brick, enamel brick, terra cotta, faiance, stone ware, silo tile, conduit, yellow ware, building block, and facing tile.

As has been true in other counties of Mississippi, the geologic survey of Scott County would not have been possible without WPA Federal funds and without the Morton Lions Club, the County Board of Supervisors, and the other good Citizens of Scott County acting as co-sponsors to the State Geological Survey. To all these agencies and individuals the Director of the Mississippi State Geological Survey expresses his profound appreciation. Especially must he mention Mr. William G. Walter, Cashier of the Bank of Morton, who is one of the most helpful and most public spirited Citizens of the State.

Very sincerely and respectfully,

William Clifford Morse,

State Geologist and Director

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*Inasmuch as additional copies of the "Scott County Fossils" part of this report are being printed separately for inclusion, in the years to come, in a combined volume on fossils, the pages of this part are numbered separately. Any workers especially interested in fossils may obtain a copy of this part on request.

ILLUSTRATIONS

MISSISSIPPI
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DIRECTOR

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SCOTT COUNTY GEOLOGY

HARLAN RICHARD BERGQUIST, PH.D.

LOCATION AND PHYSIOGRAPHY

Lying a little south of the central part of the State, Scott County comprises 597 square miles of agricultural and timbered land—a square of 16 complete townships and small portions of three others, the three being bounded on the northwest and west by the Pearl River and the Choctaw Treaty line of 1820.

The North Central Hills of the Claiborne and Terrace deposits extend across the northeastern third of the county and form red sand hills and ridges of low agricultural value. Some of these hills have a local relief of over 100 feet. To the southwest, the calcareous Jackson clays form a prairie belt that expands westward to the county line from the town of Lake, near the eastern boundary. The prevailing prairie altitude is from 360 to 400 feet.

Hills composed of Yazoo clay or of Terrace deposits and Forest Hill sands comprise the southern third of the county, many rising over a hundred feet in a quarter of a mile and attaining altitudes of over 600 feet.

A paved highway (U. S. 80) crosses the southern part of the county connecting Morton and Forest with Jackson and Meridian. State Highway 35, which passes north and south through Forest has been partly surfaced and is being improved at several places. Some of the secondary roads are graveled, but in some sections of the county these have received very little attention. This is true of portions of the Claiborne area, where, particularly in the swampy sections, the roads become impassable in wet weather. In some of the Jackson area ungraveled roads on the Yazoo clay become very slippery and sticky in the rainy seasons and deep ruts are developed. The federal aid granted to counties for road improvement is facilitating the building of better roads in Scott County.

Agriculture is the main industry though most of the farms are small and are worked either by the owners who reside on them or by tenant farmers. Cotton and corn are the chief crops. In recent years the number of cattle raised on the prairie areas has been increasing and recent annual stock shows at Forest, the county seat, indicate the rising interest in good breeds of dairy and beef cattle.

Lumbering is still extensively carried on in the county, the logs being trucked to the large lumber mills at Morton and Forest or sawn in the numerous small portable mills scattered over the region. Second growth timber of short leaf pine covers most

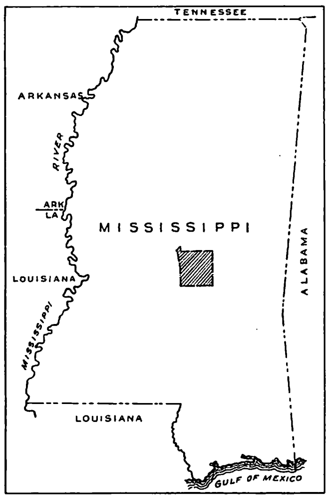

Figure 1.—Location of Scott County.

of the ridges and hills and even some of the prairie belt. Most of the better timber has been removed by former cutting but considerable reforestation has been undertaken in recent years. Bienville National Forest embraces a large part of the county and vigorous young pine are growing over areas formerly denuded. Where timber has been completely removed on highland areas and the soil disturbed by attempted cultivation but later abandoned, erosion has developed deep scars. This is particularly true of some of the sandy ridges in the southwest and although little can be done to restore these areas, further destructive erosion can be prevented by careful control and reforestation.

DRAINAGE

A line projected west of northwest across the county from a point about 2 miles south of Lake, would mark a divide. In the northern part, Coffee Bogue and Tuscolameta Creek with its tributaries (Shockaloo, Tallabogue, and Hontokala) flow north and northwest to the upper waters of the Pearl River. Two nearly parallel drainage canals have been cut across the lowland and swamp region of the bottom lands of Young Warrior Creek in the northeastern part of the county and carry their flow into the Tuscolameta.

Though the drainage is southerly in the southern tier and a half of townships, the western Strong River and its tributaries Robinson, Caney and Barber Creeks empty into the Pearl River in Simpson County, whereas Leaf River and its tributaries Tallabogue, and Tallahalla Creeks eventually send their waters into the Pascaguola River in the southeastern part of the State.

It may be that the major drainage patterns have been developed because of the structural features underlying the central part of the county which has created the general east-west divide. The secondary (in Scott County) divide which extends south of southwest from the vicinity of Forest and west of Homewood may have been influenced in a similar manner.

WATER RESOURCES

In the northeast portion of Scott County adequate supplies of water are usually obtained from the terrace sands or underlying Claiborne beds. The deepest well (195 feet) is reported[1] at Horseshoe. At Gum Springs, about 4 miles east of Hillsboro, water flows from several springs on the A. A. Eady property, coming from Yegua beds below secondary terrace deposits on the hill. A test hole (J-161) drilled 10 feet east of the road and 25 yards south of the old church logged water at 4.0 feet in terrace sand, the clays and lignitic silts of the Yegua lying at 7.7 feet and 15.0 feet respectively with a water bearing sand recorded at 18.5 feet. This is the sand that crops out above the creek level and supplies the springs.

Water obtained from shallow wells in the Jackson is limy and not very palatable. Communities and many farmers in the

Jackson belt obtain water from deep wells drilled to the Yegua. Several deep wells at Morton, Forest, and Lake penetrate the Yegua or Lisbon formations. Several wells have been drilled into the Claiborne sediments in recent years in the northwest prairie belt, but no information other than depths could be obtained. At Roosevelt State Park, 3 miles south of Morton, one of the deepest wells in the county was drilled (T. D. 895 ft.) in 1936.

In the southern part of the county, many shallow dug-wells are in use, water coming from either the Forest Hill or terrace deposits.

Though there has been extensive drilling of deep water wells in the county for the past two decades, local drillers have made no attempt either to log the wells or learn to distinguish between formations. Valuable information has been lost by this haphazard drilling. Even where wells have been drilled at the several fire towers, either the logs were never made by the drillers or at least were never furnished. When later difficulties arise over water problems the geologist or hydraulic engineer who may be consulted is handicapped by the lack of any information on the wells. Because good water is one of the most valuable resources, all governmental agencies and municipalities should realize the importance and ease of securing subsurface information at the time of drilling and request that logs of their wells be furnished by the driller, for future needs may be additionally costly when previous information has been lost.

STRATIGRAPHY

EOCENE SERIES — CLAIBORNE

LISBON FORMATION

The Lisbon is the oldest formation in the county. It strikes northwest-southeast and underlies the most northeasterly township and the north half of the township to the west. Definite exposures are few, and oxidized Pliocene terrace red sands and clays and recent alluvium make it difficult to trace. Over most of the area adjacent to the Yegua formation, the contact can be determined only with difficulty. The caving of holes drilled in terrace deposits at some points prevented ascertaining the con-

GENERALIZED SECTION OF EXPOSED FORMATIONS IN SCOTT COUNTY

		Formation	Member	CHARACTER	Maximum Thickness
RECENT		Alluvium		Stream deposits of silt and sand on bottomlands; alluvial fans—material eroded from ridges and hills.	20
PLEISTOCENE		Terraces		Fine-grained to medium-grained tan and white sands; some cross-bedding; scattered pebbles; stringers and lenses of clay	40
PLIOCENE		Citronelle		Terraces of fine-grained to coarse-grained reddish-brown and tan sand; contain lenses and scattered pebbles; cross-bedding, angular clay "breccia," petrified logs; lenses and stringers of clay Glendon limestone cobbles in base at one locality	100
		Unconformity			
OLIGOCENE	VICKSBURG		Glendon limestone	Residual siliceous cobbles containing **Lepidocyclina** sp. tests, external molds of mollusks; weathered light tan, porous; surface red and pitted.	1
OLIGOCENE	VICKSBURG		Mint Springs marl	Brown sandy clays and sands; heavy sandy clay near top; grades downward into weathered glauconitic ocherous tan micaceous clay; micaceous tan sand in basal part.	10
OLIGOCENE	VICKSBURG	Forest Hill		Silty micaceous gray or black lignitic clays laminated by gray lignitic silt or interbedded with thin layers of fine argillaceous lignitic sand; streaks and thin layers of silty lignite: sand more prominent in lower part. Silts weathered tan, clays to reddish-brown or chocolate brown; impressions of deciduous leaves in some clays.	80
		Disconformity			
EOCENE		Jackson	Yazoo clay	Calcareous, montmorillonitic greenish-gray clays, locally somewhat silty; glauconitic in lower part; weathered blocky, light tan to buff containing gypsum, small sideritic concretions and dark streaks; foraminifera abundant; scattered casts and molds or chalky shells of mollusks; **Ostrea trigonalis** bed in basal part; occasional **Zeuglodon** vertebrae.	340
EOCENE		Jackson	Moodys Branch marl	Greenish-gray glauconitic clay-marl at top, succeeded by glauconitic and pyritiferous gray and greenish-gray sands; weather tan and brown; abundant forminifera and mollusk shells.	20
		Disconformity			
EOCENE	CLAIBORNE	Yegua		Fine-grained micaceous argillaceous sands and silts or silty clays, all lignitic; oxidize to brown or tan. Upper lignitic beds drilled by Moodys Branch mollusks; thick sand in upper portion; clays and silts near base; some fossil leaves.	300
EOCENE	CLAIBORNE	Lisbon	Wautubbee	Fine-grained argillaceous and glauconitic sands, silts, and clays weathered tan or reddish brown at surface; unweathered, green or greenish-gray; contains abundant foraminifera and mollusk shells; **Ostrea sellaeformis** zone near basal part	170
EOCENE	CLAIBORNE	Lisbon	Kosciusko	Micaceous and lignitic silts, fine-grained sands, and minor layers of clay; lignite (part combustible) bed at top, contains borings of mollusks; imprints of deciduous leaves in lignite and in clays	180?

tact, but in other places where a change from lignitic sands, silts, and clays of the Yegua to glauconitic fossiliferous materials exists, a contact was established.

KOSCIUSKO MEMBER

A marine and a non-marine phase of deposition can be recognized in this Lisbon belt. The lower non-marine phase (Kosciusko) forms the oldest and also the most northeasterly area of sediments in the county. It is composed by a series of micaceous and lignitic silts and fine grained sands and minor

Figure 2.—Six-foot interval of thinly bedded non-marine silts in the Kosciusko member of the Lisbon formation, truncated by Pleistocene terrace sands. Roadcut on north-facing slope, ¼ mile southeast of railroad tracks south of Sebastopol. August 29, 1941.

layers of clay. Because typical exposures are few, and because of the extensive alluvial and terrace deposits in this region, the thickness was not determined. In a small weathered exposure, about one-fourth mile southeast of the railroad tracks south of Sebastapol, in a northward sloping roadcut, 6 feet of thinly bedded gray silts, streaked by tan, are unconformably overlain by 3 feet of coarse red terrace sand and are truncated by the deposit to the entire depth of the north end of the cut (Figure 2). Near the base of the exposure of silts, a chocolate brown layer contains the imprints of deciduous tree leaves. East of Sebastapol similar silts are likewise covered by terrace deposits which extend over the area of the entire community about the town. A quarter of a mile to the north Lisbon sands and clays are overlain by red terrace sand, and hard ferruginous fragments are embedded along the contact.

Across the entire Kosciusko belt, lignitic material was found in each test hole. A 35-foot hole on the B. Underwood property at the base of the slope south of the road on the east edge of Sebastapol, penetrated 24 feet of silts and some interbedded clay and fine sand. Lignitic particles were disseminated in most of the silt. The lowest interval of 12 feet was of fine micaceous tan sand.

A 60-foot hole was drilled on the W. O. Johnson property north of the highway at a point (near center of S. ½, NE. ¼, Sec. 2, T.8N., R.9E.) ½ mile southwest of the business district of Sebastapol.

SECTION OF THE W. O. JOHNSON TEST HOLE

Kosciusko	Depth
Sandy clay top soil. (Elev. 425)	0.4
Clay-silt, somewhat micaceous heavily oxidized tan and reddish-brown; streaks of gray. (S-2)	5.5
Sand, fine-grained micaceous light-tan to reddish-brown; thin layers of white silty clay. (S-3)	25.0
Clay, very silty micaceous light-gray; streaked by yellowish-tan. (S-4)	28.1
Clay, smooth silty gray; contains some lignitic imprints and streaks of lignitic material. Silt and lignitic content increase below 36.5 feet; some pyrite associated with lignitic material of lower silty clay. (C-5 and S-5a)	55.6
Sand, fine-grained to silty micaceous grayish-tan. (S-6) (Water at 58.0 feet)	60.0

Light-gray micaceous silt interbedded with dark-gray lignitic and pyritiferous clay was logged beneath 19 feet of fine sand in a 26-foot hole on the R. L. Monk property about 1¾ miles due west (NE.¼, SW.¼, Sec. 3, T.8N., R.9E.) of Sebastapol.

On the L. O. McClinton property (SW. ¼, NE. ¼, Sec. 9, T.8N., R.9E.) a 2.5-foot bed of solid blocky combustible lignite crops out in the bank of a stream (Figure 3) and extends another foot deeper below the surface of the water. The bed is slightly silty dark-brown to black and contains imprints of plant remains. In the lignite are vertical borings filled with fine-grained micaceous tan sand of the overlying bed. Obviously this bed marks the disconformable contact of the Wautubbee and Kosciusko beds; the relationship is similar to that of the Moodys Branch member of the Jackson above the Yegua formation. A 12-foot bed of fine-grained glauconitic sand, overlain by 5 feet of silty to sandy clay, was logged in a test hole (J-122) in the bank above the lignite. This material represents the beds below an *Ostrea sellaeformis* zone, for ferruginous ledges bearing fossil casts and molds are exposed along the roadside to the south at elevations of 6 to 10 feet above the hole. Lignitic silts

Figure 3.—Bed of combustible lignite in the Kosciusko member of the Lisbon formation, 12 to 15 feet below Ostrea sellaeformis **Conrad bed of the lower Wautubbee. South bank of stream, 1¾ miles west of Sebastopol (SW. ¼, NE. ¼, Sec. 9, T. 8 N., R. 9 E.). March, 1941.**

and sands continued to the bottom (73.3 feet) of the hole, over 50 feet below the lignite bed.

WAUTUBBEE MEMBER

The Wautubbee member of the Lisbon is composed of a series of fine-grained argillaceous and glauconitic sands, silts, and clays. In any of these sediments fossils can be found and streaks of lignitic material is not uncommon. At the surface the sediments are weathered tan and reddish-brown, rarely greenish-tan. The unweathered material from test holes is green or greenish-gray. A measured thickness of this series could not be determined because of caving, but an estimate of 125 to 150 feet was made from holes drilled across the strike. In the Adams

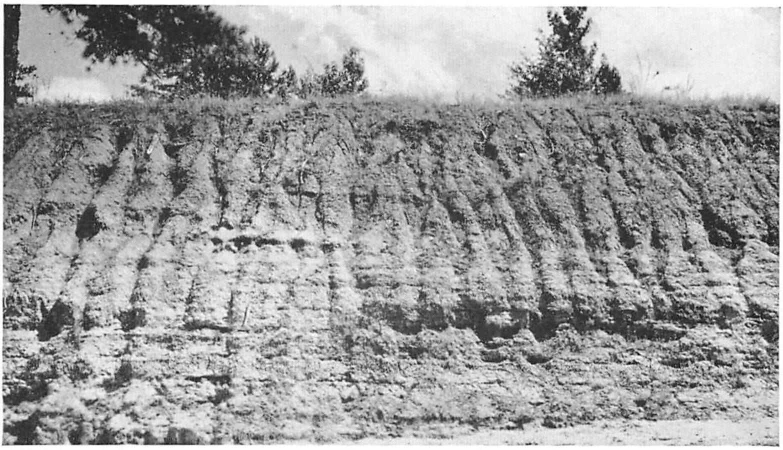

Figure 4.—Thin-bedded fossiliferous silts and sandy clays of the lower Wautubbee member of Lisbon formation, about 20 feet above Ostrea sellaeformis zone. Roadcut on north-facing slope south of the Hays community (NE. ¼, Sec. 15, T. 8 N., R. 9 E.). August 26, 1941.

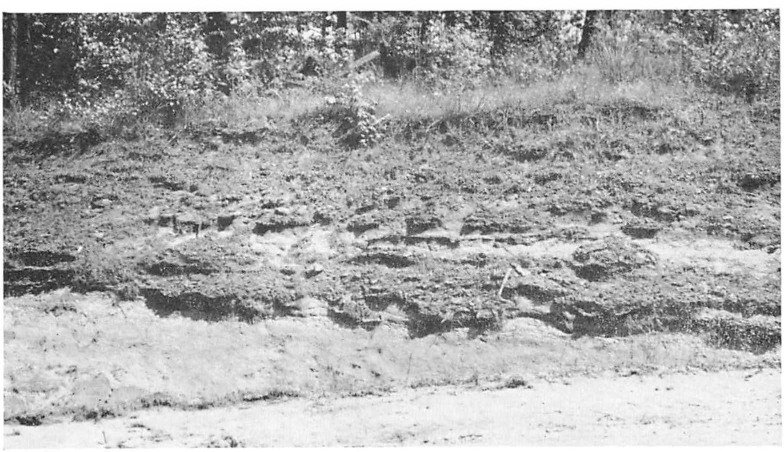

Figure 5.—Indurated ferruginous layers of Ostrea sellaeformis zone of the basal Wautubbee. Near base of roadcut on north-facing slope south of the Hays community. August 26, 1941.

Edgar Lumber Co., E. L. Martin No. 1 well (Sec. 25, T.8N., R.6E.) approximately 170 feet of fossiliferous glauconitic sand and clay was penetrated, the upper 90 feet being largely sand. The normal regional dip is 20-25 feet per mile to the southwest. The deepest hole (J-110; NW. Cor., Sec. 13, T.8N., R.8E.) was drilled about midway in the Wautubbee belt through 65.7 feet of marine sediments without indication of penetrating non-marine materials. Of this footage, 18 feet were composed of silty or sandy glauconitic clays and the remainder of fine-grained glauconitic sand.

A zone of *Ostrea sellaeformis* Conrad shells lies near the base of the Wautubbee member. A good exposure of this bed (Figure 4) may be seen in the lower part of a section on the east side of a roadcut on a hill south of the Hays community (SE. ¼, SW. ¼, NE. ¼, Sec. 15, T.8N., R.9E.). In the lower part of the outcrop shells of *Ostrea sellaeformis* Conrad are found in a glauconitic and ferruginous indurated calcareous sand. Laterally this bed grades into limonitic and concretionary ledges (Figure 5) of a foot or two in thickness. In the limonitic layers leaching has destroyed all shells, but the imprints of fossils, particularly external molds, are abundant.

SECTION IN ROAD CUT ON HILL SOUTH OF HAYS COMMUNITY

	Feet	Feet
Wautubbee marl member		70.7
Top of hill—Elevation 438 feet		
Clay, sandy glauconitic somewhat gypsiferous gray and tan mottled reddish-brown; greatly jointed by weathering; top 3 feet oxidized a dark brick red and intensely leached and weathered	14.0	
Silt, thin bedded micaceous gray; thin sandy limonitic hard laminae; gradational into beds above	3.0	
Clay, silty gray, streaked brown; interbedded with fine-grained gray to brown somewhat cross-bedded sand; thin layers of silt; internal molds of mollusks	7.5	
Clay, sandy glauconitic tan and brown; dark manganese (?) mottlings; conchoidal jointing in upper part; fossil imprints; in lower 3 feet, chalky shells. (Two-thirds of bed covered)	17.5	

Sand, fine-grained brown, interbedded with fossiliferous irregular limonitic layers of one to several inches thickness or divided into thin layers by sand; abundant imprints of mollusks, in top layer some well preserved *Ostrea sellaeformis* shells in glauconitic sandy gray clay and indurated ferruginous sand; lime nodules at top, many showing partial replacement by limonite....................................	9.7
Sand, fine-grained micaceous, ferruginous light tan to gray; cross-bedded; thin clay laminae along some bedding planes..	13.0
Clay, silty gray, mottled heavily by tan ferruginous coloring; cut by numerous small joints, slickensides; upper part weathered very brown....................................	6.0
Base of hill in east roadside ditch	

Figure 6.—Ferruginous fossiliferous ledges containing imprints of Ostrea sellaeformis **Conrad, in the basal sands of the Wautubbee. Roadcut on south-facing slope, 1½ miles southeast of the Hays community (NW. ¼, NE. ¼, SE. ¼, Sec. 23, T. 8 N., R. 9 E.). August 26, 1941.**

In a test hole on this hill, Kosciusko beds below the basal exposure were penetrated. A 3-foot bed of compact lignite lies below 8 feet of lignitic silt and sand underlying the basal sands and clays of the marine beds. Fine-grained to silty micaceous lignitic sands lie below the lignite. The lignite bed does not bear the same relationship to the marine beds as on the McClinton property 1½ miles to the northwest.

At two other localities (SE. ¼, SE. ¼, NE. ¼, Sec. 35, T.8N., R.9E. and near the west edge of NW. ¼, SW¼, Sec. 25, T.8N.,

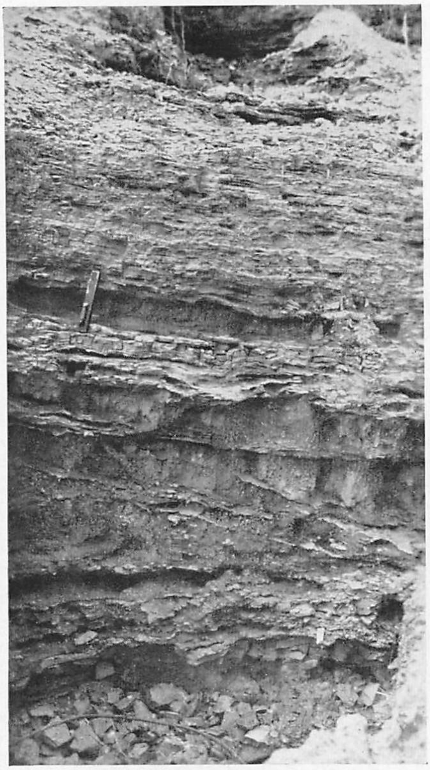

Figure 7.—Clay and interbedded sand of the Wautubbee member of the Lisbon formation. Roadcut on hillside, 1½ miles northwest of the Horseshoe community (S. ½, NE. ¼, SE. ¼, Sec. 6, T. 8 N., R. 9 E.). August 26, 1941.

R.9E.) along hillside roadcuts the shells of the basal *Ostrea sellaeformis* zone of the marine phase are well preserved in small exposures. The zone, however, can be traced across the county, but at most places the shells have been leached away and only the outcropping or broken ferruginous ledges bearing fossil imprints are found (Figure 6).

At an estimated 50 feet above the base of the *O. sellaeformis* zone, irregular thin layers of marine clays interbedded with sand are exposed in a roadcut on the eastward slope of a hill (S. ½, NE. ¼, SE. ¼, Sec. 6, T.8N., R.9E.) 1½ miles northwest of Horseshoe or about 4½ miles west of Sebastapol (Figure 7).

SECTION 1½ MILES NORTHWEST OF HORSESHOE

	Feet	Feet
Terrace deposits		50.0
Top of hill—Elevation 511 feet		
Sand, fine-grained slightly micaceous reddish-brown; somewhat cross-bedded but generally massive; limonitic fragments and pebbles in upper few feet; stringers and lenses of gray silty clay	50.0	
Lisbon (Wautubbee) formation		34.2
Clay and sand, interbedded; clay smooth to silty micaceous thinly and irregularly bedded, chocolate-brown and tan to gray; conchoidal jointing; laminated by micaceous gray and ferruginous silt; interbedded with fine-grained tan and red micaceous sand; sand and clay irregularly bedded and lensed	14.7	
Sand, fine-grained tan, interbedded with thin layers of gray and brown micaceous and silty clay	4.7	
Clay, smooth chocolate-brown to gray; laminated by silt and thinly bedded; conchoidal jointing where thickened; glauconitic sand lenses in basal part; internal molds of mollusk shells scattered throughout	4.8	
Clay, weathered and highly jointed sandy micaceous, glauconitic gray and tan (largely along fractures); upper part very sandy gray; streaks of yellow silt in base of ditch; scattered internal molds of mollusk shells	10.0	
Covered to flood plain.		

Foraminifera are found in abundance in some of the upper Lisbon sediments in the material sampled from unweathered beds logged in test holes. Only two exposures were found which yielded a few foraminifera at the outcrop. In one of these exposures located about 1¼ miles west of the Carthage road and about ¼ mile south of the Leake County line (NW. ¼, NE. ¼, Sec. 4, T.8N., R.8E.) numerous well preserved shells of gastropods and pelecypods and a few corals (*Flabellum* sp.) were collected. This exposure is in a hillside gully where tan, glauconitic silt, and dark-brown glauconitic, gypsiferous clays are interbedded. Sand underlies the clay and contains the better preserved fossils. Fossiliferous sands and clays similar to these were found in several test holes along the strike of this belt which averages 4 miles in width.

About 0.6 of a mile south of the Leake County line on the Walnut Grove road, there is an exposure of Wautubbee material in the east roadcut and ditch of a north facing hill. The hill is capped by 5 or 6 feet of fine-grained argillaceous reddish-brown terrace sand containing scattered quartz and chert pebbles, some bearing Paleozoic coral and crinoid imprints. Below the terrace sand are 16 feet of Wautubbee clays underlain by 4 feet of sand. The upper clays are thin-bedded silty gray separated by thin irregular laminae and layers of ferruginous and micaceous silt. Where gullying has occurred the clay has eroded into thin step-like layers. The lower 9 feet of the clays are predominantly grayish-tan and more uniformly bedded, partings being less numerous. These clays are likewise silty, slightly micaceous, and where thinly bedded are gypsiferous. The basal 4 feet of the exposure are composed of fine-grained to medium-grained argillaceous glauconitic greenish-gray sand stained greenish-yellow on the surface and laminated by thin yellow silty clay. In the upper one foot of the sand, the clay laminae are numerous and grade into the massive clays above.

A 49-foot test hole, about 10 feet above the base of the exposure, logged 10.6 feet of sand below the clays, the lower 5.6 feet being greenish-gray and containing fragments of mollusk shells. Seven feet of dark-gray glauconitic clay-silt containing abundant foraminifera, echinoid spines and shell fragments lie beneath the sand and are, in turn, underlain by 22 feet of dark gray argillaceous and glauconitic silt which is somewhat micaceous and pyritiferous and contains scattered foraminifera and mollusk shell fragments.

A mile north of Horseshoe (N. ½, SE. ¼, Sec. 5, T.8N., R.9E.), gullies along the roadside expose 15 to 20 feet of thinly bedded gray silts and silty clays which grade into brown where weathered. These clays are in part smooth and jointed but contain lenses of silt. Internal molds of mollusk shells are present throughout the exposure.

YEGUA (COCKFIELD) FORMATION

Sands and clays of the Yegua are exposed intermittently in a belt averaging 5 miles in width, lying northeast of the Jackson area of outcrop and trend northwest across the county from the vicinity north of Lake. Its contact with the Jackson is nowhere recognizable and therefore was mapped entirely from auger hole data. The lower contact with the Lisbon is even more difficult to ascertain, and its limits could only be approximately defined, for there are no exposures showing where a contact can be drawn. Even where drilled, difficulty was encountered in the caving of sands so that very few test hole contacts could be obtained.

Good exposures of the Yegua are rare though there are many road cuts and gullies showing a few feet of weathered sands and clays of this formation.

Over considerable areas the formation is overlain by recent alluvial deposits or Pliocene and Pleistocene (?) terrace sands, some containing lenses of gravel. Where exposed the Yegua sands are tan to reddish-brown, in places streaked with gray, and the clays are similarly colored but usually mottled by ferruginous material. Ferruginous colorings prevail down to the water table or through the zone of oxidation. Below the permanent water table, lignitic particles are disseminated through the sands and clays, and beds of silty lignite are common.

A series of smooth or silty clays and micaceous silts with fine disseminations of lignite and pyrite predominate in the lower Yegua. In a few of the test holes, the basal beds were of silt or fine-grained sand having glauconite scattered or streaked in it, indicative of fluctuating marine and non-marine conditions during deposition. The Lisbon contact was placed where persistent glauconitic sands appeared.

Silty lignitic clays of the basal Yegua were drilled in a test hole on a hilltop on the Joe Warren property (SW. ¼, NE. ¼, SE. ¼, Sec. 6, T.7N., R.9E.) 0.1 mile south of Brister branch.

TEST HOLE J-121, JOE WARREN PROPERTY

	Depth
Terrace deposits (?)	
Sandy loam—Elevation 415 feet—Altimeter	1.2
Clay-silt, somewhat arenaceous oxidized brown; streaks of light-tan (S-2)	3.2
Sand, fine-grained light-tan to reddish-brown; thin streaks of white clay (S-3). Water at 14.0 feet	18.5
Yegua formation	
Clay-silt, micaceous gray and black. Clay black and stiff. Silt largely light-gray and very micaceous; contains some lignitic	

material and disseminated granules of pyrite; silt interbedded with clay in contrasting bands (S-4)	31.3
Clay, smooth silty black; contains grains of pyrite and flakes of mica; layers and partings of gray silt, increasing in lower portion (S-5a and S-5b)	50.5
Wautubbee member of Lisbon	
Clay, arenaceous, glauconitic and somewhat micaceous dark greenish-gray; contains shell fragments and tests of foraminifera (S-6)	56.5

Fine white micaceous sand is present in the lower part of the upper Yegua. This was encountered in numerous test holes in the mid portion of the Yegua belt and was seen in cuttings around shot holes drilled by a seismograph crew working in the same area. In the Adams Edgar Lumber Co., E. L. Martin No. 1 well (Sec 25, T.8N., R.6E.) a 60-foot section of this sand was penetrated at 120 feet, beneath clays and lignite. In this same well fine sand and silty clay persisted from the 230-foot depth to a depth of 280 feet. The remaining beds of the lower Yegua were predominantly silty lignitic clay. Although this well was drilled to a total depth of 6,520 feet, formational units of the upper portion only were determined from a study of cuttings from 47 to 1130 feet (cuttings on file at the offices of the State Geological Survey).

ADAMS EDGAR LUMBER CO., E. L. MARTIN NO. 1; 1980 FEET FROM EAST LINE AND 330 FEET FROM SOUTH LINE OF SEC. 25, T.8N., R.6E. DRILLED IN MAY, 1940. T. D. 6,520

Jackson formation

0-20	No samples
47	Marl, fossiliferous, sandy glauconitic

Yegua formation

70	Clay, brown and gray
100	Clay, gray
120	Lignite
180	Sand, fine white (contamination of Jackson forams, ostracods and glauconite)
200	Clay, lignitic
220	Clay, silty
230	Clay, lignitic and silty
240	Sand, fine; silty clay

250 Sand, fine

260 Sand, fine; silty clay

270 Sand, fine; silty and lignitic clay

300 Clay, silty and lignitic

310 Lignite and lignitic silty clay

350 Clay, silty lignitic

Lisbon formation

Wautubbee marl

420 Sand, glauconitic, contains forams and mollusk shell fragments; lignitic silty clay (possibly contamination)

430 Sand, glauconitic fossiliferous

440 Sand and clay, glauconitic; forams and small mollusk shells

520 "Marl," and clay; scattered quartz grains; mollusk shell fragments, increasing with depth; some lignitic (contamination ?) fragments in upper part

Kosciusko member

560 Lignite and fine white sand; some marl (contamination ?)

570 Clay, red; manganese ? nodules; fine sand; shell fragments

700 Sand, fine white; grains subangular to rounded

Winona and Tallahatta members

720 Lignite and fossiliferous (forams) marly clay; some of latter oxidized red (possibly Zilpha clay)

740 Sand, fine white with some lignite; bryozoa and other fossil fragments in lower part

750 Marl, fossiliferous gray and tan; some clay and lignite

770 Marl, fossiliferous glauconitic containing forams and shell fragments (coral and Ostrea sp.); some silty lignitic clay

780 Marl, gray sandy; shell fragments and lignite

800 Marl, glauconitic sandy tan; shell fragments, sand and manganese? nodules

820 Clay, lignitic gray; sandy marl and shell fragments

860 Marl, soft glauconitic; shell fragments

970 Marl, gray glauconitic; oyster shell fragments, some forams and mollusk shells; pyrite and increasingly sandy in lower part

1040 Marl, fossiliferous glauconitic sandy gray

1100 Siltstone, glauconitic gray

1130 Siltstone, slightly glauconitic gray

Where they are unoxidized, the uppermost 40 or 50 feet of Yegua materials are composed of fine-grained micaceous argillaceous sands and silts or silty clays, all containing finely disseminated lignitic particles or interbedded with silty lignite. Laminations of white silt are common. Where somewhat oxidized, the clays vary from lignitic black and dark-gray to chocolate brown. Streaks of fine granular pyrite may be seen in most of the lignite and lignitic clays.

At only one place in the county does a lignite bed of the Yegua, upper phase, show at the surface—at "Coal Bluff" on

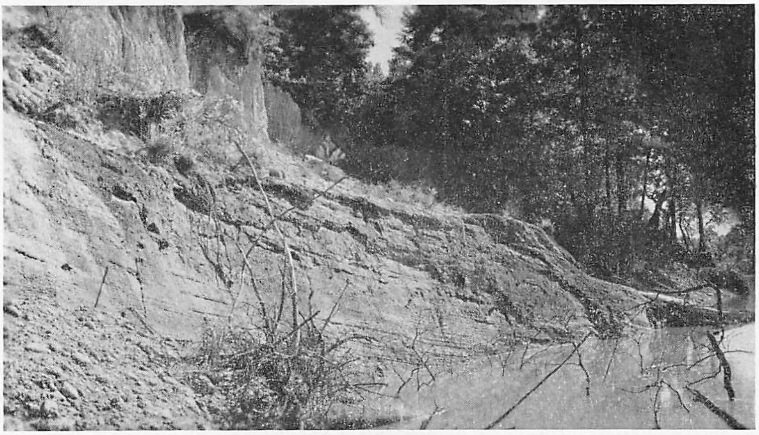

Figure 8.—South portion of the Yegua lignitic beds at "Coal Bluff" (NW. Cor., Sec. 34, T. 9 N., R. 5 E.) showing simulated dip into Pearl River in northwestern Scott County. August 30, 1941.

the east bank of Pearl River 3½ miles west and 1½ miles north of Ludlow (NW. Cor., Sec. 34, T. 9 N., R. 5 E.). A somewhat lenticular deposit of lignitic shale and silty lignite underlies about 15 feet of cross-bedded coarse-grained brown and white Pleistocene (?) sands containing scattered quartz pebbles. A 15-foot to 20-foot bed of white and yellow sandy clay covers the sand. The deposit is thinly bedded and appears to dip into the stream at the south end of the exposure (Figure 8) where it is very sandy, but this has obviously been produced by slumping of the bluff. At the thickest point, nearly 12 feet of material is exposed (Figure 9) and continues beneath the low water level of the river. To the North the bed is from 4 to 6 feet thick. In the basal 1.5 or 2.0 feet there are small uniformly shaped worm (?) borings of about one-half to three-fourths of an inch in length, thickly perforating the lignite and associated

Figure 9.—Twelve-foot exposure in the central portion of the lignitic beds at "Coal Bluff". August 30, 1941.

Figure 10.—Surface of the basal portion of lignitic beds at Coal Bluff showing worm (?) borings. August 30, 1941.

clay (Figure 10). About 1.5 feet of the exposure is solid lignite. The following analysis[2] shows it to be high in sulphur.

Moisture	13.50	Sulphur	4.10
Volatile matter	39.66	Calories	4,972
Fixed carbon	36.50	B. T. U.	8,950
Ash	10.34		

Deciduous leaf imprints were found at one locality in the Yegua (NE. ¼, NE. ¼, SE. ¼, Sec. 2, T. 8 N., R. 7 E.) at a point about a half mile south of Leake County line, where a few feet of chocolate colored clays, containing the imprints, are exposed in the west side of a roadcut on the south slope of a hill. Two feet of thin-bedded, white and yellow silty clays overlie the leaf bearing clays. About 6 feet of white and yellow mottled and weathered argillaceous sands are above the clays. Terrace sands cap the top of the hill.

As at other localities in the state, the Yegua in Scott County has borings in the uppermost beds immediately beneath the glauconitic sands of the Moodys Branch. These mollusk borings in the Yegua were evidently made and filled during early Jackson time. In test holes such sands appear to be interbedded with the lignitic beds but likely represent fillings of borings which were inclined to the sea bottom at the time of deposition.

In the northwest part of the county a reentrant of the Yegua has been mapped. This extends southeast from the vicinity of Ludlow for 5½ miles along Coffee Bogue. The region is relatively flat and is covered by Pleistocene or Recent sands and gravel to a depth of 18 or 20 feet. Recent alluvium is spread over the lowlands adjacent to Coffee Bogue. Seemingly the area was dissected by a Pleistocene stream which cut a shallow valley 25 to 50 feet below the Jackson area to the east and was subsequently filled by terrace materials that have spread over adjacent areas and cover most of the Yegua region in range 5 east. The Yegua reentrant reflects a long gently arched anticlinal nosing which is part of the structural folding prevalent in the county.

Northwest of Ludlow are undifferentiated terrace deposits and alluvium covering the Yegua and no defineable exposures of the latter are seen. In roadcuts within ½ mile west of

Ludlow, are terrace gravels. Holes in this area penetrated gravels 18 to 20 feet below the surface. In the sandy offset area (T. 9 N., R. 5 E.) of the county, heavy terrace and alluvial deposits are found. Some drilling was done in this area but the thickness could not be satisfactorily obtained. Along Pearl River there are exposures of white and tan sand, some bearing quartz pebbles. Most of this region is wooded and little agriculture is carried on.

Ferruginous sand concretions and nodules are found on some of the hills in the Yegua belt. It could not be determined if these originated in the Yegua or in terraced materials overlying Yegua beds. These are much like the "native gravels" of Webster County where development has been in the Ackerman formation and the material is locally used for road surfacing.

The thickness and normal rate of dip of the Yegua were not determined from auger hole data, but some recent information is available from several oil test wells in the central part of the county which indicate that the Yegua is 280 to 300 feet thick. The published logs[3] of water wells at Forest and Morton list about 100 feet of Yegua. In these logs "white packed sand" is assigned to the Lisbon. This type of sand, however, was found in test holes only in the Yegua belt, and was the only material found at the surface around deep shot holes drilled by seismograph crews in the same area. Considering this and the recent oil well data, it seems necessary to revise the interpretation of the water well logs furnished by the late E. N. Lowe for Water Supply Paper 576.

In a well on the Adams Edgar Lumber Company (formerly Hall-Legan Lumber Company) property[4] in Morton, all the material logged beneath 307 or possibly 341 feet should be assigned to the Yegua and none to the Lisbon.

In the public well at Forest[5] the upper 60-foot interval belongs to the Jackson as is indicated, but the remainder should be assigned to the Yegua. The bed of "limestone" considered the top of the Lisbon is likely a hard cutting bed of sand.

In the Alabama and Vicksburg Railroad well[6] near the station at Forest, 65 feet of material belong to the Jackson; the base of the Yegua is probably at the 361-foot depth and the remaining part of the log can be assigned to the Lisbon formation.

In the Forkville area the C. M. Duncan well (SW. 1/4, Sec. 2, T. 7 N., R. 6 E.) located 1½ miles *north* of the village, was logged as having 40 feet of Yegua and 25 feet of Lisbon materials[7]. The Yegua is not exposed at this point and certainly the basal portion is not close to the surface anywhere in the area. The writer interprets this well as having penetrated 61 feet of Jackson, the basal 12 feet being the Moodys Branch member, and 4 feet of Yegua.

The Graham No. 1 well (NE. 1/4, SE. 1/4, Sec. 21, T. 6 N., R. 8 E.) 1 mile south of Forest was drilled by the Mississippi Oil and Gas Trust Company in 1923-24, and a log was published in 1928.[8] A reinterpretation of the upper part of this log is necessary. A test hole near the site of the old well penetrated 102.5 feet of the Yazoo clay. The hole was abandoned in a hard drilling limy clay interpreted as being lower Yazoo. Because the top of the Yegua in the Alabama & Vicksburg Railroad station well in Forest is at an elevation of approximately 406 feet and the Jackson is about 65 feet thick, it is scarcely possible that at the "oil well" site, one mile farther south, the Jackson has thickened to 240 feet and that the top of the Yegua is as low as 240 feet above sea level. If a fault were considered in this area, it would have to be of tremendous displacement to account for such a great thickening over this short distance. The writer, therefore, considers that approximately 125 feet of the log is in the Jackson and the next 305 feet in the Yegua, placing the top of the Lisbon at the 430-foot depth.

JACKSON FORMATION

Clays of the Jackson comprise the surface material over a large portion of the county, having weathered to form the soil of the prairie land areas of the central part and the hill regions in the southeast and south-central portion. Yazoo clay exposures in gullies and along roadcuts are common from the alluvial covered areas in the south-central part of the county north and eastward to the edge of the formation.

MOODYS BRANCH MARL MEMBER

Though there are not any recognizable exposures of the Moodys Branch marl member of the Jackson, this horizon was traced in test holes across the county in ascertaining the areal extent of the Jackson and in numerous holes drilled to the Yegua contact in the north central prairie land area. Over much of the lower Jackson, alluvial sands and terrace deposits obscure the basal beds. Auger holes indicate the lower limits extend irregularly northwestward from a mile north of Lake on the eastern edge of the county, to Ludlow in the northwest. South of Ludlow, along Coffee Bogue, an alluvial covered eroded reentrant of Yegua carries the boundary south 5½ miles or nearly to the line between T. 7 and 8 N. Along the north edge of T. 8 N., R. 5 E., heavily oxidized basal beds of this member seemingly strike westerly to the county line, but are obscured by alluvium.

In the area drilled this member was usually 12 to 15 feet thick and at a few places 18 to 20 feet, as shown in the series of stratigraphic test hole records. Where weathered the material is a silty or sandy tan clay or a fine-grained brown sand containing partly altered glauconite. Unweathered beds are 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. Abundant foraminifera, ostracod tests, and either water-worn pieces of mollusk shells or unbroken shells, are scattered through the sand. A small amount of lignitic material, reworked from the Yegua beds, is present at some places, in the basal portion. Above the sands in a thin layer, a foot or two feet thick, of greenish-gray fossiliferous glauconitic clay-marl which in places is indurated to a hard lime in the topmost 2 or 3 inches. In a few places where leaching and weathering had been extensive, the basal part of the upper beds contained limestone concretionary nodules up to 2 or 3 inches in length.

YAZOO CLAY MEMBER

The lower Yazoo clays contain a zone of large oyster shells (*Ostrea trigonalis* Conrad) about 48 to 50 feet above the base of the formation. This bed is exposed at several localities across the county and is a consistent horizon marker. It was found at points near the adjacent Yegua belt, and in the western part of the county at a number of exposures well removed from the marginal limits of the Jackson. In places this bed yielded a few fragmentary *Zeuglodon* bones, though most fossils of this animal have been found in the upper portion of the formation. The weathered clays in the lower Jackson are highly silty, light-tan streaked by gray and by iron oxide. Hard limestone nodules and a small amount of glauconite are scattered in this lower part. The lower Yazoo clay is exposed in a roadcut at the W. M. Christian property (NW. 1/4, SW. 1/4, NE. 1/4, Sec. 4, T. 6 N., R. 8 E.) on State Highway 35, about 2 miles north of Forest.

ROADCUT SECTION OF LOWER YAZOO CLAY 2 MILES NORTH OF FOREST

Yazoo clay	Feet
Clay, weathered and jointed gray and tan	4
Clay, sandy glauconitic fossiliferous; weathered light-tan to gray; ferruginous streaks and small lime nodules	10
Clay, sandy tan and gray; contains *Pecten perplanus* (Morton) and abundant bryozoa which in places form a friable coquina-like limestone	3
Clay, silty to sandy tan; abundant shells of *Ostrea trigonalis* Conrad, many scattered in adjacent field; fragments of *Zeuglodon* jawbone. Bed partly covered	6
Base of exposure and mouth of test hole J-168 — Elevation 426 feet	

Lower beds of Yazoo clay and Moodys Branch glauconitic clays were penetrated in a test hole (J-168) near a drainage ditch 35 yards east of the highway.

TEST HOLE J-168, W. M. CHRISTIAN PROPERTY, 2 MILES NORTH OF FOREST

Yazoo clay	Depth
Topsoil of dark-brown and black weathered clay	1.3
Clay, calcareous grayish-tan; streaked by tan; foraminifera exceedingly abundant but considerably weathered; scattered small lime nodules (S-2)	12.0
Clay, calcareous greenish- gray; sticky when wet; contains finely comminuted lime or shell material, abundant small foraminifera and scattered ostracods, byrozoa, and chalky mollusk shells (C-3a)	28.5
Moodys Branch marl member	
Clay, calcareous, glauconitic greenish-gray; contains chalky	

shell fragments and abundant foraminifera; dark-green glauconite and quartz sand streaks prominent (C-3b and C-4)... 46.5

Yegua formation

Sand, fine-grained argillaceous and carbonaceous; contains mica and pyrite; streaks of glauconitic sand (S-5)............ 47.5

The Moodys Branch marl and the clays in the interval between the basal Jackson member and the *Ostrea trigonalis* zone are not exposed in the county. Test holes revealed the lower Jackson lithology and logs of a few are included in lieu of outcrop data.

SECTION OF TEST HOLE J-137 ON PERRY SIMMONS PROPERTY, IN WOODS ON NORTH SLOPE OF HILL, 30 YARDS EAST OF COUNTY ROAD, ¾ MILE NORTH OF LAKE,
(SE. ¼, SE. ¼, SW. ¼, SEC. 13, T.6N., R.9E.)

	Depth
Undifferentiated Jackson and alluvium	
Topsoil, black sandy loam (Elev. 454 feet)....................	0.5
Clay, arenaceous reddish-brown and tan (S-2)................	4.0
Clay, arenaceous rust-brown, minor gray areas; streaks and concretions of iron carbonate; scattered quartz pebbles (S-3)	10.0
Lower Jackson (Moodys Branch member ?)	
Clay, tan and gray, glauconitic in part; chalky lime nodules concentrated in streaks; streaks of dark sideritic material; abundant foraminifera in less weathered portions (S-4)....	13.0
Moodys Branch marl member	
Greensand marl, fine-grained argillaceous tan; glauconite partially altered pale green; lime particles and shell fragments throughout; foraminifera abundant (S-5). Water at 17.0 feet	19.2
Yegua formation	
Clay, silty tan laminated by white silt and streaked by greenish-brown sand (S-6)..................................	24.0
Clay, silty lignitic gray to black; granular pyrite concentrations; thin micaceous gray silt laminae at intervals (P-7)..	30.0
Sand mixed with clay, fine-grained slightly micaceous black; lignite and granular pyrite throughout; 3-inch glauconitic sandy clay in uppermost part (S-8; S-8a)................	33.5
Silt, micaceous lignitic thinly laminated light-gray and dark-gray; granular pyrite associated with lignitic material (S-9)	34.5

SECTION OF TEST HOLE J-163 IN FLAT WOODED AREA, 15 FEET WEST OF ROAD, AND 1¼ MILES SOUTHWEST OF LAKE

(NW. ¼, NW. ¼, SW. ¼, SEC. 25, T.6N., R.9E.)

Undifferentiated Yazoo clay and alluvium	Depth
Topsoil of brown silty clay and loam (Elev. 450 feet)........	0.5
Clay, silty brown to gray; streaks and mottlings of rust-brown and of black sideritic material; scattered quartz pebbles and lime nodules (S-2)..	11.4
Lower Yazoo clay	
Clay, silty-calcareous very light-tan, streaks of brown and gray; foraminifera abundant, the smaller individuals giving a silt-like texture, all considerably weathered; scattered weathered ostracods and mollusk shells (S-3)...................	23.0
Clay-marl, gray silky texture due to abundant foraminifera tests; from 35 feet downward it grades into darker color and smoother texture with better preserved fossils; scattered glauconite in lower part; occasional pyrite granule. (S-4a; S-4b; C-4c)	47.0
Moodys Branch marl member	
Clay-greensand-marl; very glauconitic greenish-gray; abundant fragments of mollusk shells and tests of foraminifera and ostracods; scattered pyrite (C-5a; S-5b)..................	62.3
Yegua formation	
Clay, silty gray and black, slightly pyritiferous and micaceous; thin silt laminae and streaks of fossiliferous greensand—may in part be contamination from overlying bed (C-6)........	70.5

SECTION OF TEST HOLE J-166 ON S. A. DEARMAN PROPERTY, EAST EDGE OF FIELD, 300 YARDS NORTH OF U. S. HIGHWAY 80, 2.5 MILES EAST OF FOREST

(NW. ¼, NE. ¼, SW. ¼, SEC. 18, T.6N., R.8E.)

Yazoo clay (*Ostrea trigonalis* valves on surface)	Depth
Clay, silty arenaceous dark brown and black grading downward into tan; contains small brown siderite nodules, nodules of lime and fragments of *Ostrea trigonalis* shells (S-1; Elev. 438 feet)	4.0
Clay, highly calcareous light gray-tan, streaks and markings of brown; small foraminifera abundant but almost completely weathered; lime nodules and chalky shell fragments scattered and so weathered the clay has a silty appearance (S-2)	15.3
Clay, calcareous greenish-gray; innumerable small weathered foraminifera and mollusk shell fragments give a silt-like texture (S-3)	20.0

Clay, marly glauconitic and fossiliferous (chalky mollusk shell fragments and foraminifera) greenish-gray (S-4)..........	28.5
Moodys Branch marl member	
Clay, calcareous glauconitic somewhat sandy and pyritiferous greenish-gray; hard glauconitic sand layer at top; basal foot largely greensand containing large broken shells including *Ostrea trigonalis;* foraminifera, ostracods and mollusk shells (broken by auger) very abundant (C-5a; C-5b)......	44.0
Yegua formation	
Sand, fine-grained argillaceous and carbonaceous gray to black; streaks of glauconitic sand; pyrite granules throughout (S-6)	46.2

SECTION OF TEST HOLE J-192 ON EAST EMBANKMENT OF ABANDONED ROAD BEND, 150 YARDS SOUTH OF BRIDGE OVER TRIBUTARY STREAM OF COFFEE BOGUE, 2.5 MILES SOUTH OF LUDLOW (SE. ¼, NE. ¼, SE. ¼, SEC. 17, T.8 N., R.6E.)

Undifferentiated Yazoo clay and alluvium	Depth
Topsoil, sandy black loam (Elev. 354 feet).................	0.6
Clay, silty tan, streaks of unweathered gray; small black siderite concretions about size of BB shot; a few quartz pebbles (S-2)	7.0
Yazoo clay	
Clay, slightly silty calcareous light creamy tan, darker streaks; fragments of shells and scattered foraminifera (S-3)......	20.0
Clay, calcareous gray glauconitic and pyritiferous; shell fragments and foraminifera; hardened dry layer at 26.0 feet (S-4 25 ft.-30 ft.)...	33.0
Moodys Branch marl member	
Sand, fine-grained glauconitic greenish-gray; shell fragments of mollusks and foraminifera throughout (S-5).............	52.6
Yegua formation	
Lignite, silty black laminated by gray silt and fine gray sand; pyritiferous in part (S-6)..............................	55.0
Silt, argillaceous black and dark brown lignitic; streaks of gray silt and of lignite (S-7)..........................	65.1

SECTION OF TEST HOLE J-193 ON JACK ARMSTRONG PROPERTY, 60 FEET WEST OF ROAD, 25 FEET SOUTH OF TENANT HOUSE

(NE. ¼, SW. ¼, SEC. 28, T.8N., R.6E.)

Alluvium	Depth
Clay, silty to arenaceous light-tan to brown; gray streaks in lower 7 feet; laminated by thin layers of silt and streaked by black sideritic (?) material (Elev. 365 feet)...................	12.0

Yazoo clay	
Clay, calcareous-silty tan; weathered a mealy texture; contains chalky shell fragments and foraminifera; scattered soft green glauconite (S-2)	16.8
Moodys Branch marl member	
Silt, calcareous glauconitic gray; contains foraminifera and shell fragments; scattered glassy quartz grains (S-3)	20.6
Sand, pyritiferous fine-grained calcareous argillaceous very glauconitic greenish-gray; mollusk shell fragments and foraminifera scattered throughout (S-4)	33.6
Sand and silt interbedded; sand fine-grained glauconitic similar to bed above; silt black and lignitic (S-5)	37.6
Yegua formation	
Silt and fine-grained sand; thinly laminated lignitic dark-brown micaceous (S-6)	39.0

Though a general flatness typical of prairie land has been developed on the Jackson in the north half of the Morton quadrangle and extends east of Forest, hills constitute about half of the area underlain by the clays. Especially in the southeast part of the county the clays are exposed extensively on hills.

On several hills there is a relief of 100 feet of Yazoo clay over a relatively short distance. At Bald Hill (NW. ¼, SW. ¼, Sec. 35, T. 6 N., R. 9 E.) 2 miles southwest of Lake and 3¼ miles from the edge of the Jackson belt, the Jackson is estimated to be about 230 feet thick and is capped by 18 feet of primary terrace sand and gravel. This estimated thickness of the Jackson is based on elevation readings and data from test holes which penetrated the Yegua contact, one at a point 0.6 mile north of U. S. Highway 80 at Lake and one at 1.7 miles south-southwest of the same point. The dip averages 27 feet per mile across this area. An interval of 153 feet of Yazoo clay was penetrated in 3 test holes at different elevations on Bald Hill.

Likewise other hills in the southeastern part of the county are composed of Yazoo Clay, and most of them are capped by several feet of terrace sands and gravels. Adjacent to the hills covered by extensive Forest Hill and terrace sands in the southwestern and south-central part of the county, alluvial sands and silts have been spread over large areas of eroded Yazoo Clay.

Relatively fresh exposures in gullies along hillsides contain smooth clays that are usually jointed and blocky having a surface coloring of light tan or grayish-tan. Frequently dark stains of iron oxide mottle the surface and coat the joint planes. Where layers are especially calcareous, surface induration and weathering have in places combined to produce a rounded boulder-like

Figure 11.—Euhedral single and twinned crystals of gypsum lying on the surface of weathered Yazoo clay on the side of Pinkston Hill (near south edge of S. ½, SE. ¼, Sec. 17, T. 5 N., R. 9 E.). August 30, 1941.

effect. Ferruginous silty clay may be present along joints and where clays are highly weathered mottlings of reddish-brown iron oxide are prominent. In the upper 4 or 5 feet of some of the more heavily weathered clays are abundant lime nodules and small round ferruginous concretions. In some exposures the ferruginous concretions are so abundant that the clay has a pisolitic appearance. In extreme weathering a crumbly structureless tannish-gray clay is characteristic, and granular soils are produced that are sticky when wet.

Soils developed in situ from the Yazoo Clay are in part heavy black gumbo or sticky tan silty clay. Particularly in the prairie land areas the clay is of the dark gumbo type, low in lime, the leaching action of ground water having removed most of the lime. Over large areas mingled alluvium has produced a sandy clay loam.

Gypsum crystals are common along joints and bedding planes where ferruginous material has been concentrated in the weathered clays, and were frequently found in the test holes or scattered on the surface of exposures. In some areas such as Bald Hill and Pinkston Hill, single and twinned euhedral crystals up to 3 inches long have been weathered out of the clay and have accumulated on the hillsides (Figure 11).

Lignitic particles were noted in small silty "pockets" in some of the clays and did not seem to be confined to a particular zone in the section.

At many places small quartz pebbles are embedded in weathered clays near the surface. Some are in basal clays, but in the south-central part of the county, pebbles were found in upper beds. Because the pebbles are present in clays throughout the Jackson belt and not confined to the basal part, the writer interprets them as having been incorporated at a later time (Pleistocene?) by penetration into joints during alluvial deposition on the clays. As weathering proceeded the pebbles have become firmly embedded in the clays.

The unweathered clays, which are found in some gullies and coincident with the ground water table in some test holes, are non-gypsiferous, calcareous, montmorillonitic, and uniformly greenish-gray, and in some places contain dark finely comminuted marcasite streaks.

The total thickness of the Jackson south of Morton is estimated to be about 340 feet as logged in the water well drilled in Roosevelt State Park in 1936.

LOG OF WELL, ROOSEVELT STATE PARK, 2 MILES SOUTH OF MORTON. DRILLED BY J. H. MULLEN OF C. M. JOURNEY COMPANY; COMPLETED JUNE 23, 1936. ELEV. 496, ALTIMETER. FORMATIONS INTERPRETED BY WRITER

	Depth
Terrace and Forest Hill, undif.	
Red sand and clay	55
Jackson formation	
Yazoo clay member	
Blue gumbo	121.8
Hard sand rock	122.8
Blue gumbo	133.8
Sandy gumbo	200.7
Free drilling shale	291.8
Sticky gumbo	324.5
Sand rock	326.5
Sticky gumbo	357.0
Moodys Branch member	
Hard shale	378.7
Yegua formation	
Sandy shale	484.2
Shells and shale	532.7
Sand rock, medium hard	542.5
Sandy shale	662.5
Hard gray sand	674.2
Lisbon formation	
Wautubbee member	
Sticky gumbo	736.1
Rock	736.6
Sandy shale	777.5
Hard flint rock	779.5
Shale	782.5
Hard rock	783.1
Sandy shale	791.1
Brown gumbo	800.6
Hard flint rock	801.6
Gumbo	820.2
Sandy gumbo	838.2
Kosciusko member	
Hard gray sand, coarse at base	889.4
Sticky gumbo	895.7

In a well drilled on property that is now the Adams Edgar Lumber Company of Morton, a thickness of 307 feet was recorded,[9] but the upper portion of the formation is eroded. No other deep wells have been drilled through the entire section. To the north in the central part of the county, several water wells and the recent wells drilled by oil companies show the Jackson formation to be irregularly thinned over large areas, but erosion of structural features accounts for the difference in thickness. In this area the Jackson averages about 50 feet in thickness, in places as far as 5 miles from the margin of the belt.

In the area covered by the Forest Hill formation, a thin layer of bentonite was frequently found at the top of the Yazoo Clay where test holes penetrated the contact. This bentonite is not thicker than a few tenths of a foot and may be the equivalent of the horizon noted by Mellen[10] in Yazoo County, where it is about 40 feet below the top of the formation. Possibly in Scott County, material may once have overlain this thin bentonite bed but was subsequently removed by erosion. A mile west of Bald Hill (SW. 1/4, Sec. 34, T. 6 N., R. 9 E.), Bay[11] records a thin bentonite bed a few feet below the top of a hill. An 85-foot test hole drilled by this survey on top of the hill north of the road failed to reveal this bed, although some evidence of

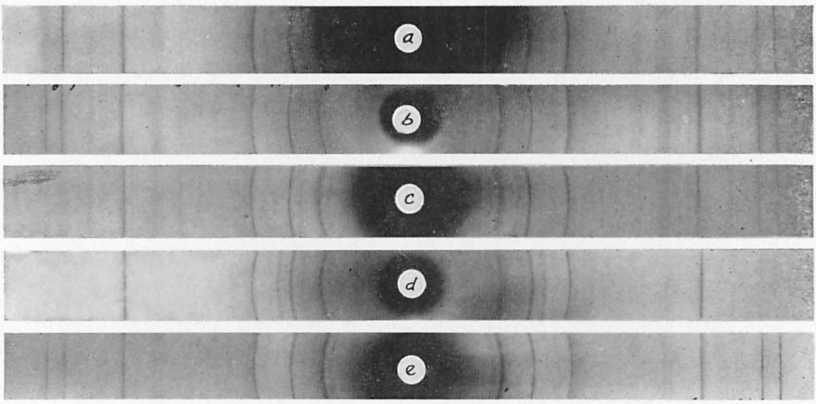

Figure 12.—X-ray patterns of bentonite and clay from the Yazoo member in Scott County, Mississippi compared with patterns of bentonite from Wyoming. Photographs and determinations by J. W. Gruner, Department of Geology, University of Minnesota.

a. Montmorillonite (plus quartz) pattern of bentonite from the top of the Yazoo clay. Roosevelt State Park, 2 miles south of Morton.
b. Montmorillonite (plus quartz) pattern of bentonite from the top of Yazoo clay. Gully in gravel pit opposite Morton fire tower, 1 3/4 miles north of Morton.
c. Montmorillonite (plus quartz) pattern of the weathered upper Yazoo clay. Gully in gravel pit opposite Morton fire tower.
d. Montmorillonite (plus calcite) pattern of the unweathered Yazoo clay. Test hole near top of Bald Hill, 2 miles southwest of Lake.
e. Montmorillonite pattern of characteristic Wyoming bentonite. Lavoye, Wyoming. F. F. Grout collector.

it is to be found in the deep gully on the south. Since this bentonite is about 200 feet above the base of the formation, it can hardly be the same zone noted by others in Yazoo and Hinds Counties.

A 6-inch to 8-inch bed of impure creamy-tan bentonite, containing pockets of yellow silt and impressions of mollusks, lies at the top of fossiliferous smooth ocherous-yellow Yazoo Clay and beneath primary terrace sands and gravels in a gully north of the gravel pit west of Morton fire tower. This is the only exposure of bentonite in Scott County and in all probability is the same horizon as that beneath the Forest Hill sands south of Morton.

X-ray analyses of a few samples of weathered and unweathered Yazoo clay and the thin bentonite layer at the top show montmorillonite to be the clay-forming constituent; some quartz and calcite are also present. A comparison of 2 clay samples and 2 Yazoo clay bentonites with Wyoming bentonite shows the same diffraction patterns of the mineral montmorillonite (Figures 12a to 12e).

At the top of the Yazoo clay in nearly every hole through the Forest Hill contact, silt outlines of *Textularia mississippiensis* (?) Cushman are in the upper one or two feet and were present even where the clay was weathered brown or tan. The presence of these ghost-like arenaceous outlines, some filled with marcasite, is evidence that the upper clays of the Yazoo are entirely marine in Scott County and are sharply separated from the overlying non-marine lignitic materials of the Forest Hill formation. Calcareous foraminifera may have been present originally but would have been destroyed by the leaching action of circulating ground waters charged with humic acid from the lignitic beds immediately above.

Foraminifera are abundant almost throughout the entire Jackson section. The check list in the "Fossils" section indicates the species and range. Ostracods are associated with the foraminifera. Internal molds of mollusk shells, usually pelecypods such as *Corbula wailesiana* Conrad, *Yoldia* sp., *Pecten perplanus* (Morton) and the little solitary coral *Flabellum cuneiforme* Lonsdale exist at several localities and in some exposures the soft shells, along with gastropod shells, may be found in situ. Small echinoid spines are also common in the clays. Bryozoa associated with *Pecten perplanus* (Morton) were collected at two localities from material above the *Ostrea trigonalis* Conrad bed.

In unweathered gray clays exposed in gullies on Pinkston hill (NE. ¼, NW. ¼, NE. ¼, Sec. 20, T. 5 N., R. 9 E.) there are abundant delicate thin mollusk shells. Most of them are too readily crushed to be collected but the following are common: *Callocardia securiformis* (Conrad), *Protocardia nicolleti* Conrad, *Venericardia rotunda* Lea, *Corbula wailesiana* Conrad and *Turritella* sp. Several large Zeuglodon vertebrae (*Basilosauus cetoides*?) and fragments of ribs were seen partly weathered from the clays at the same locality (Figure 13).

Figure 13.—Zeuglodon vertebrae weathered from the upper beds of the Yazoo clay, in the south slope of Pinkston Hill (NE. ¼, NW. ¼, NE¼, Sec. 20, T. 5 N., R. 9 E.) August 30, 1941.

OLIGOCENE-VICKSBURG SERIES

FOREST HILL FORMATION

Beneath alluvium and the Pliocene Terrace sands, the Forest Hill formation or its weathered equivalent underlies the hill and ridge area to the south and southwest of Morton and the greater portion of T. 5 N., R. 6 E., and extends westward into Rankin County and southward into Smith County. The formation underlies Terrace sands in the ridge east and south of Pulaski and the hills southwest of Homewood.

At the surface where weathering has oxidized the sediments, fine micaceous tan sands and silts interbedded with reddish-brown, tan or dark chocolate-brown silty clays are present. Some of the chocolate-brown clays contain leaf imprints. Unweathered Forest Hill material from drill holes disclose a series of silty micaceous gray to black clays containing disseminated lignitic particles. These are for the most part laminated by gray lignitic silt or interbedded with thin layers of fine-grained argillaceous lignitic sand. Streaks and thin layers of soft silty lignite, usually a few tenths of a foot in thickness, are found

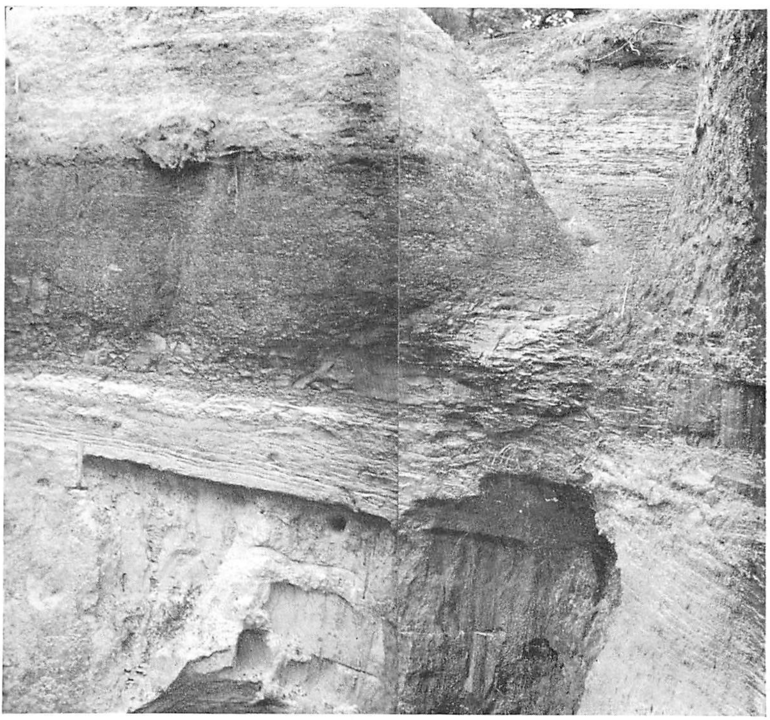

Figure 14.—Basal Forest Hill sands and lignitic silty clays in a gully near the city water plant on the west side of Morton. August 26, 1941.

at intervals through the sand and clay. Streaks of granular pyrite, some associated with carbonized wood, are present in some of the lignite and clays. In the lower part of the formation sands predominate, but basal beds are for the most part silty and sandy lignitic clay.

Much of the area underlain by this formation is covered by alluvium derived from the Terrace sands and gravels which cap most of the higher ridges. Typical Forest Hill exposures are, therefore, restricted to a few areas, and only the weathered material can be seen in a few roadcuts and gullies. The best exposure (Figure 14) is near the city water plant in the west side of Morton where recent erosion has cut into a hillside.

SECTION NEAR CITY WATER PLANT, WEST MORTON

	Feet	Feet
Forest Hill formation		38.0
Clay, silty thin-bedded micaceous grayish-tan; laminated by thin layers of silt; irregular iron oxide concentrations along parting planes and imprints of fragmentary leaves scattered throughout; irregular contact with terrace sands above but lower portion has gradational downward change into lignitic beds below. From 17.0 to	23.0	
Clay, silty lignitic dark-brown to black; lower portion massive, jointed and conchoidally fractured, major joint system in general NW.-SE. direction; iron oxide along joints; upper portion thin bedded; lower contact irregular. From 5.5 to	6.5	
Sand, fine-grained to silty micaceous; gray and tan marked by thin yellow iron oxide streaks; upper 1.5 to 2.5 feet contains thin-bedded silt and ocherous-yellow clay; widely separated thin layers of smooth gray clay in lower 6 feet, but general appearance is massive; weathered surface of bed tan and "splintery"	8.5	

Additional sections from test holes indicate the relationship of the Forest Hill sediments to the Yazoo clay and to the younger terrace deposits.

SECTION OF TEST HOLE J-26 ON W. B. STEGAL PROPERTY, AT EDGE OF WOODS, 25 FEET WEST OF ROAD, ¼ MILE SOUTH OF ROAD FORK (SW. ¼, SW. ¼, SW. ¼, SEC. 17, T. 5 N., R. 6 E.)

	Depth
Alluvium	
Sand, fine-grained to medium-grained yellow and tan; limonitic concretions. (Elev. 463, Alt.)	3.6
Forest Hill formation	
Clay, very sandy yellow mottled gray (S-1)	7.0
Clay, silty gray mottled tan	7.9
Sand, fine-grained gray and tan; streaks of clay. Water at 8.4 feet	11.6

Clay, silty and sticky gray; crossed by network of tan streaks; mottled a chocolate brown at 15-foot depth (S-2)	15.7
Clay, silty plastic; light-gray mottled by small concretions and yellow streaks of limonite (C-1)	20.5
Silt and clay, dark-gray; contain finely comminuted lignitic material and a few nodules of iron oxide; some thin laminae of light-gray silt (C-2)	32.3
Sand, fine-grained slightly micaceous and argillaceous gray and tan; 0.3 foot layer of dark lignitic clay at 36.2 ft.	37.7
Silt, slightly micaceous lignitic gray; thinly laminated by clay (S-3)	43.6
Clay, slightly micaceous lignitic gray; thin laminations of silt (S-4)	45.7
Silt, slightly micaceous gray; laminated by clay; contains finely comminuted lignite and pyrite (S-5)	47.1
Sand, fine-grained gray; contains black streaks of lignitic material and greenish-gray clay	49.4
Silt, gray; laminations of clay (S-6)	51.8
Silt and lignite, alternately laminated gray and black; contains some clay (S-7)	52.6
Clay, silty lignitic gray (S-8)	53.8
Clay and silt, thinly laminated lignitic gray (S-9)	55.8
Sand, fine to silty gray; lighter laminations and lignitic streaks (S-10)	60.2

SECTION OF TEST HOLE J-28 ON A. BRADSHAW PROPERTY, NEAR SMITH COUNTY LINE IN ABANDONED LOGGING ROAD ON WEST SLOPE OF RIDGE, ABOUT ¼ MILE WEST OF BRADSHAW RESIDENCE (SE. COR., SEC. 32, T. 5 N., R. 6 E.)

Alluvium or Citronelle	Depth
Sand, coarse-grained reddish-brown to yellow and white. (Elev. 468 ft. Alt. Water at 12.0 feet)	18.7
Forest Hill formation	
Silt, light-gray and yellow (S-1)	22.1
Clay, silty gray; laminated by white silt (S-2)	24.8
Clay, silty lignitic light-gray	26.8
Sand, fine-grained light-gray; contains a small amount of clay	29.8
Clay, silty dark-gray; streaks of lignitic material and laminations of white silt (S-3)	30.9
Lignite, dark-brown; streaks of tan sand (C-2)	36.7

Silt, light gray; slight clay bond (S-4)	39.7
Sand, fine-grained light-gray and green	41.9
Lignite, dark-brown and black; a few layers of light-brown clay (S-5)	43.7
Clay, dark-gray; thin layers of white silt; scattered nodules of pyrite (S-6)	46.4
Sand, fine-grained greenish-gray and green; some clay	47.8
Clay, silty greenish-gray and green; laminated by white silt (C-3)	51.5
Sand, fine-grained greenish-gray and green	52.9
Clay, smooth stiff slightly micaceous dark-gray; laminations of white silt (C-4)	57.5
Sand, fine-grained gray; interbedded with clay (S-7)	59.6

SECTION OF TEST HOLE J-30 ON J. H. SMITH PROPERTY, AMONG TREES IN PASTURE 100 YARDS EAST OF RIGHT ANGLED ROAD TURN (SW. ¼, NW. ¼, SE. ¼, SEC. 19, T. 5 N., R. 6 E.)

	Depth
Forest Hill formation	
Soil of fine-grained brown sand and loam. (Elev. 433 feet, Alt.)	1.8
Sand, fine-grained; brown-streaked by gray and yellow; thin layers of clay	4.0
Sand, fine-grained yellow and gray; laminated by clay	9.0
Sand, fine-grained gray. Water at 13.0 feet	13.2
Sand, fine-grained dark-gray laminated by gray clay	14.8
Clay, sandy gray; streaks of gray sand in lower portion (C-1)	27.3
Lignite, soft black and brown (S-1)	28.4
Clay, silty; streaks of green and brown sand (S-2)	31.0
Clay, silty dark-gray (S-3)	31.9
Sand, fine-grained gray	43.9
Clay, dark-gray; laminated by white silt (S-4)	46.5
Sand, fine-grained greenish-gray and dark-gray; streaks of lignite and gray clay (S-5)	49.7
Yazoo clay	
Clay, silty greenish-gray; a few pyrite nodules (C-2)	52.5

SECTION OF TEST HOLE J-32 ON R. M. MIZE PROPERTY, BESIDE PINE TREE 50 YARDS NORTH OF ROAD, ¼ MILE EAST OF RANKIN COUNTY LINE (SW. ¼, SE. ¼, SW. ¼, SEC. 31, T. 5 N., R. 6 E.)

	Depth
Forest Hill colluvium	
Sand, fine-grained yellow, red and gray. (Elev. 395 feet, Alt.)	9.7
Clay and silt, alternately laminated gray and yellow; silt slightly micaceous; clay layers mottled yellow. Water at 9.0 feet (S-1)	11.2

Forest Hill formation	
Clay, gray; laminated by thin layers of white and yellow silt; lignitic and pyritiferous along dark streaks in clay (S-2)	14.3
Clay, lignitic dark-gray; thin laminations of light-gray silt (S-2a)	18.3
Silt, somewhat argillaceous, lignitic dark-gray to black (S-3)	19.3
Clay, silty greenish-gray; scattered streaks of lignite (S-4)	21.3
Clay, silty slightly micaceous mottled dark-gray and brown; streaks of disseminated lignite and pyrite (S-5)	25.2
Silt, gray slightly micaceous; laminated by lignitic clay (S-6)	36.9
Sand, fine-grained light-gray mottled brown and greenish-gray	38.7
Yazoo clay	
Clay, slightly silty plastic greenish-gray; abundant foraminifera at 43.0 feet; pyritic nodules in lower portion (S-7 and S-8)	44.2

SECTION OF TEST HOLE J-34 ON T. E. FOSTER PROPERTY (NE. ¼, SW. ¼, SW. ¼, SEC. 33, T. 5 N., R. 6 E.), BASE OF EAST SLOPE OF RIDGE, ABOUT 300 YARDS SOUTHEAST OF HOUSE AND ¼ MILE NORTH OF SMITH COUNTY LINE

Citronelle colluvium	Depth
Sand, coarse-grained tan; brown and white. (Elev. 473 feet, Alt.)	8.0
Forest Hill formation	
Clay, silty light-gray mottled yellow; streaks of sand; thin layer of dark-gray clay at 9.5 feet (S-1). Water at 9.0 feet	11.7
Sand, fine-grained gray and tan; small amount of clay; 0.3 foot layer of yellow sand at base	14.7
Clay, lignitic black (S-2)	16.7
Sand, fine-grained gray and brown	20.5
Clay, sticky very lignitic silty somewhat pyritiferous light-brown and dark-brown (C-1)	25.0
Clay, silty very lignitic light-gray and brown (S-3)..........	27.2
Lignite; streaks of gray sand; dark gray clay in basal 0.3 foot (S-4)	28.9
Clay, very sandy somewhat pyritiferous gray and brown......	30.8
Clay, silty lignitic dark-gray and brown (S-5)	33.2
Clay, silty lignitic dark-gray (C-2)	36.1
Sand, fine-grained dark-gray and brown; streaks of clay (S-6)	45.5

The maximum thickness of the Forest Hill formation in Scott County does not exceed 60 or 70 feet, but, because of the extensive erosion of the area, thinner deposits are more commonly present. In the vicinity of Pulaski the thickness is only 10 to 40 feet and the sediments lie beneath thin beds of terrace sands. South of Homewood a thickness of about 50 feet is attained, and the formation appears to thicken toward the county line.

The basal contact always appeared to be sharp, and evidence from the numerous auger holes into the Yazoo clay suggests that a disconformity exists that is always well defined. Usually the lower 15-foot to 20-foot interval was predominately fine-grained lignitic sand and silt interbedded in part with thin layers of gray or black lignitic clay and streaks of lignite. In twelve holes showing good contact, 8 had 10 or 15 feet of sand interbedded with clay above the Yazoo clay, and one had 19 feet of overlying sand. In one hole the basal Forest Hill was a very silty clay laminated by gray silt and lignite. In the sands lying close to the surface in the zone of oxidation, most of the lignitic material is weathered, so that beds are largely tan or brown.

Two blocks west of the Scott County Hospital at Morton, brown lignitic argillaceous fine-grained sand is exposed along the hillside adjacent to the street. This sand immediately overlies the Yazoo clay, and a two-foot hole into the underlying formation showed the contact to be sharp, the Yazoo clay being greenish-gray and containing fragile silt outlines of *Textularia mississippiensis* (?) Cushman. This same sharp contact was seen in other test holes in the Forest Hill area, both south of Morton and in the vicinity of Pulaski and Homewood. This sharp contact is interpreted as evidence of a disconformity between these beds and the Yazoo clay. The U. S. Geological Survey classification has been followed in this study, and the Forest Hill beds retained as a member of the Vicksburg of the Oligocene.

The contact with the overlying terrace sands is usually irregular, but in a few places it is sharp and regular over a small area. In the Tip Stuart gravel pit 3.5 miles south of Morton, the top of the Forest Hill clay is irregularly indurated with yellow iron oxide to a thickness of 3 or 4 inches (Figure 15). Imprints of leaves are present in this hardened limonitic layer.

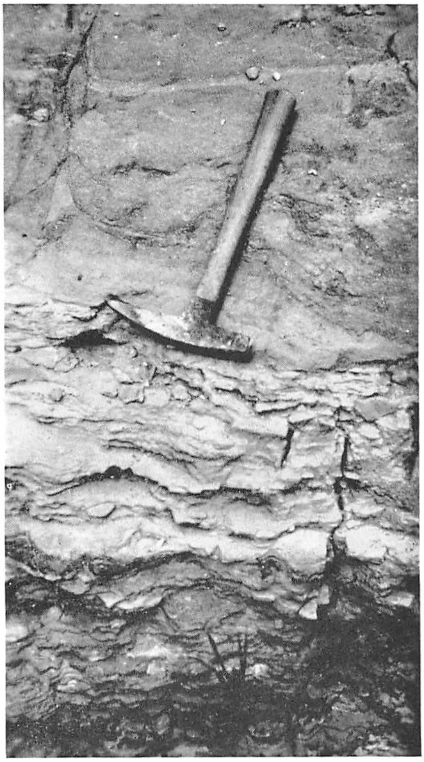

Figure 15.—Citronelle terrace sands overlying clays and indurated ferruginous layers of the Forest Hill beds, the upper layers of which contain deciduous leaf imprints. Floor of the north end of Tip Stuart gravel pit, 2.5 miles south of Morton. August 30, 1941.

At other localities the silts of the Forest Hill "merge" into the terrace sands.

GLENDON AND MINT SPRINGS MEMBERS

Material assignable to these members is present in only one small area in the county (SE. 1/4, Sec. 17, T. 5 N., R. 6 E.). At this place, beneath 30 to 40 feet of light-tan to reddish-brown fine-grained argillaceous and micaceous terrace sand containing thin stringers of silty gray clay, are residual cobbles of the Glendon limestone and weathered sands and sandy clays of the Mint Springs.

MINT SPRINGS MARL

In small gullies on cut-over hill slopes are exposures of weathered Mint Springs and either scattered *Lepidocyclina* tests or pitted red residual cobbles of the Glendon limestone. Test holes disclose about 8 to 10 feet of ferruginous sandy clays and sand of the Mint Springs member. The basal 3-foot or 4-foot interval, resting on fine-grained light-tan micaceous sands of the Forest Hill, is argillaceous tan sand grading upward into a greenish-tan sandy clay, which about midway in the section contains weathered glauconite in an ocherous-yellow micaceous, sandy clay. Near the top the material is a dark-brown heavy sandy clay.

GLENDON LIMESTONE

The Glendon limestone formerly capped the Mint Springs material, but now only scattered siliceous residual cobbles remain. A considerable number of these lie on the surface of a cultivated hillside on the White property north of the road, and some are incorporated in the base of the red terrace sands. The pitted surface of these cobbles is reddish-brown, but in the porous and leached interior they are light-tan. These contain abundant tests of *Lepidocyclina* sp. and occasional imprints of the exterior of gastropods and small pelecypods (*Nerithea* sp., etc.). At several places the siliceous disc-like tests of the foraminifera have weathered out and lie on the surface. Actual outcrops in place could not be found.

At several places on the hill sides farther southeast, ferruginous sandstone is traceable and appears to be part of the Mint Springs member. Elsewhere the Mint Springs and Glendon have either been removed by erosion before the terrace deposits were laid down, or were not recognized in the test holes or gullies. The Mint Springs marl is so intensely weathered and so similar in appearance to the overlying terrace deposits that it was originally overlooked but was noted by Watson Monroe[12] who worked in the area several years ago.

PLIOCENE AND PLEISTOCENE

TERRACE DEPOSITS

Large areas of Scott County have surficial coverings of sand, and in places are concentrations of gravels. In general such deposits in the State have been referred to the Citronelle and considered Pliocene age. In the southern part, in Scott County, however, the coarser sands and gravel deposits are not spread over the older formations in an extensive continuous blanket as has been inferred, but instead are limited to the higher ridges and hills. Sand along the slopes is either colluvial terrace materials or weathered Forest Hill, if in the southern part of the county, and Claiborne, if the northern area is considered. On the lowlands adjacent to the hills, are alluvium and some terrace deposits of a younger age than those on the ridges. Thus, instead of collectively considering all this material as Pliocene and belonging to the Citronelle, there can be distinguished at least two generations of terrace materials, the older being either late Pliocene or early Pleistocene in age and the younger of later Pleistocene origin. The alluvial and colluvial materials appear to belong to late Pleistocene and Recent.

CITRONELLE TERRACES

The most extensive deposits of the older terrace beds extend along the ridge from the vicinity of Morton southward to the county line and are present on the ridges east and southeast of Pulaski and southwest of Homewood. Isolated "outliers," some partly indurated, cap the higher hills of the Yazoo clay in the southern part of the county and are scattered along smaller ridges at several localities. In the northern part a long linear ridge of equivalent terrace sands, containing scattered gravels, extends along the Harperville to Walnut Grove road. The continuity of this terracing is interrupted at only a few places. Other terraced ridges, north and northwest of Steel, and isolated hills, capped by these deposits, are located here and there along the area adjacent to the Leake County line.

Most of the Citronelle terrace materials are reddish-brown, irregularly bedded to massive argillaceous fine-grained to coarse-grained sands, containing scattered quartz gravels and thin stringers of gray or mottled clay. Cross-bedding of sands and of

Figure 16.—Angular clay blocks and clay pebbles in a matrix of red sand of the Citronelle terrace deposits. Floor of the north end of Wm. G. Walter gravel pit, one mile south of Morton. August 31, 1941.

Figure 17.—Citronelle terrace sands and gravels in the east face of Wm. G. Walter gravel pit, west of the ridge road, one mile south of Morton. August 31, 1941.

Figure 18.—Angular sand and silt blocks in a sand and gravel matrix. East face of Wm. G. Walter gravel pit, one mile south of Morton. August 31, 1941.

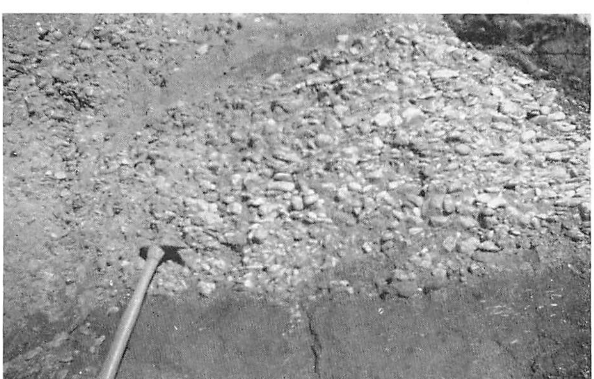

Figure 19.—Gravel lens in red sand of the Citronelle terrace. Gravel pit west of Morton fire tower, 1¾ miles north of Morton. February 1941.

gravel concentrations is common, an excellent exposure of which is in the new highway cut on the east edge of Harperville. Other evidence of rapid stream deposition can be seen in the Wm. G. Walter gravel pit one mile south of Morton, on the west side of the ridge road. In the floor of the north end of this pit, numerous clay pebbles and angular blocks of gray silty clay, laminated by red silt, lie at all angles in a matrix of fine-grained red sand (Figure 16). The angularity of such clay materials indicates that the blocks were transported very short distances from the source. On the east wall of the pit the irregularity of the deposition can be seen (Figure 17), and the rapidity of accumulation is clearly indicated by the large angular blocks of sand and silt that lie scattered in a matrix of sand and gravel (Figure 18). Rapid channel filling apparently occurred over this particular area.

At several localities gravels composed of rounded pebbles of quartz, chert, siliceous oolites, and agate have been concentrated in lenses in the sand (Figure 19). Paleozoic corals and crinoidal stem imprints are common in the chert pebbles which together with an occasional brachiopod suggest the source may be from limestone areas of the Appalachian plateau.

Petrified wood is commonly associated with the sands and gravels and fragments are abundantly scattered at the surface where weathering has split pieces from larger sections. The material is usually white or grayish-tan on the surface and lacks the brilliant colors of petrified wood from the southwestern part of the United States. In a great deal of the silicified wood, minute quartz crystals line interstitial fractures developed along the grain. A few logs were found that are so large that they could not have been transported in a silicified state with the gravel and must have been petrified in situ (Figure 20). Apparently many trees were carried by the Pliocene or early Pleistocene streams and buried in the rapidly built floodplains.

Lenses of gray clay, some silty, are in the terrace deposits at a few localities. Usually these amount to little more than enlarged stringers, but, on the Henry Stuart property (SW. ¼, NE. ¼, NW. ¼, Sec. 21, T.5N., R.6E.), a bed which is probably lenticular in shape attains a thickness of 15 to 20 feet. This clay varies from a silty to smooth clay but in general appears to have qualities which make it applicable for pottery usage. About 5 feet of a smooth uniformly massive light-gray clay of this bed is exposed in a small gully about 200 yards northwest of the house. The logs of test holes at this deposit are given elsewhere.

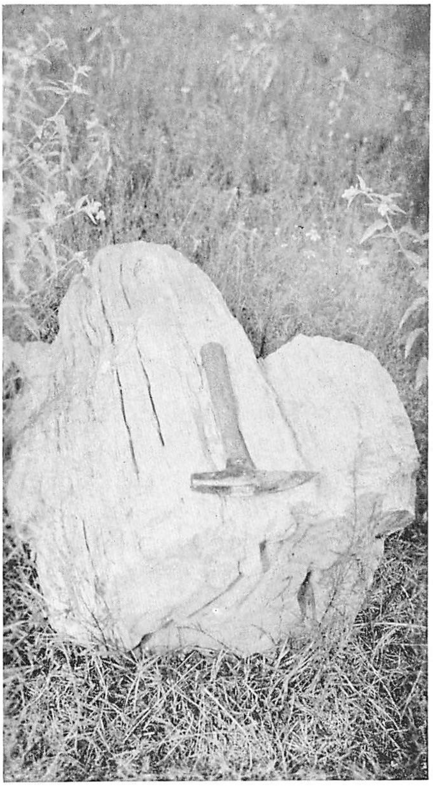

Figure 20.—Petrified log from the Citronelle terrace sands of Tip Stuart gravel pit, 2.5 miles south of Morton. August 31, 1941.

The thickness of the Citronelle terrace deposits increases from 20 feet at Morton to nearly a hundred feet in the Mt. Olive Church area 6.5 miles to the south. On the ridges are generally 40 to 60 feet of sands; on isolated hills, 20 to 40 feet. North of Harperville to the Leake County line the sands are at least 50 to 60 feet thick on parts of the long northerly trending ridge.

Several sand and gravel pits have been opened on the ridges where deposits contain a high gravel content. Three are operated adjacent to the road south of Morton and one in the outlier 2 miles to the north. One pit south of the Forest Fire tower (NW. ¼, Sec. 32, T.6N., R.8E.) on a hill capped by sand and gravel has furnished considerable material for highway construction. A greater concentration of gravels seems to be in the deposits in the southern part of the county than in those to the north, making the former deposits more desirable.

The elevations of the basal contact of the Citronelle terrace beds with Yazoo clay or Forest Hill materials vary in different sections of the southern portion of the county. At the Forest Fire tower (NW. ¼, NW. ¼, Sec. 32, T.6N., R.8E.) the contact is 580 feet; in the vicinity east and south of Pulaski, the contact at points 3.5 and 5.0 miles from the tower is 500 feet and 400 feet respectively, a dip of 80 feet and 140 feet. On Mathes Hill 3 miles south of Forest the base of these deposits lies on the Yazoo clay at approximately 520 feet, and 4 miles farther south, at 500 to 480 feet. Bald Hill, 2 miles southeast of Lake, has a capping of 8 feet of sand and clay containing quartz and chert gravels and residual ferruginous quartz conglomerate in contact with the Yazoo clay at approximately 585 feet. On Pinkston Hill 3 miles farther southeast red sands of the same age extend down to the 540-foot contour line.

In contrast, the elevations of this contact in the western part of the county are as follows: 500 feet at the Morton fire tower 1¾ miles north of Morton; 540 at Morton where it continues at approximately the same elevation for the next two miles on the ridge south of town. The contacts are slightly below 480 and 500 feet in the Mt. Olive Church area and south from it to the county line.

On the east edge of Homewood unweathered Yazoo clay is found beneath 14 feet of fine sands and silty clays on the hill top. At the crossroads about 100 yards west, 10 feet of fine sand is exposed in a cut behind Bishop's store. In a test hole at the base of the cut, an interval of 22 feet of interbedded clay and fine sand was logged. The hole caved, and the depth to the Yazoo could not be determined but it must be at least 25 or 30 feet lower than at the adjacent locality on the hilltop. At the

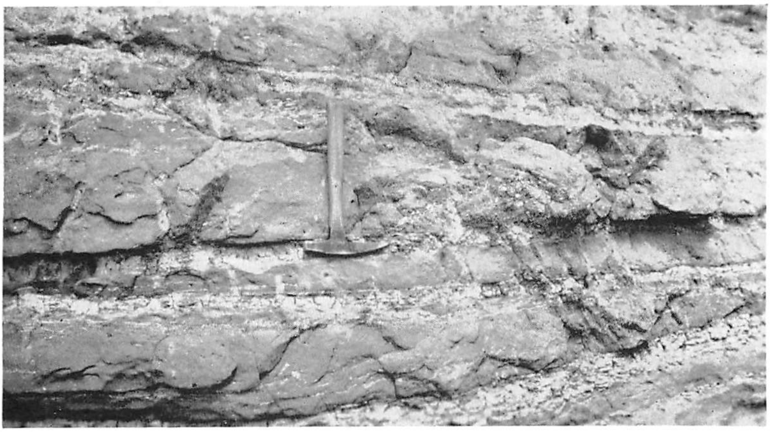

Figure 21.—Pleistocene terrace deposits of red sand and interbedded clay stringers. Road cut (Center, Sec. 2, T. 8 N., R. 9 E.), ¾ mile southwest of Sebastopol. August 26, 1941.

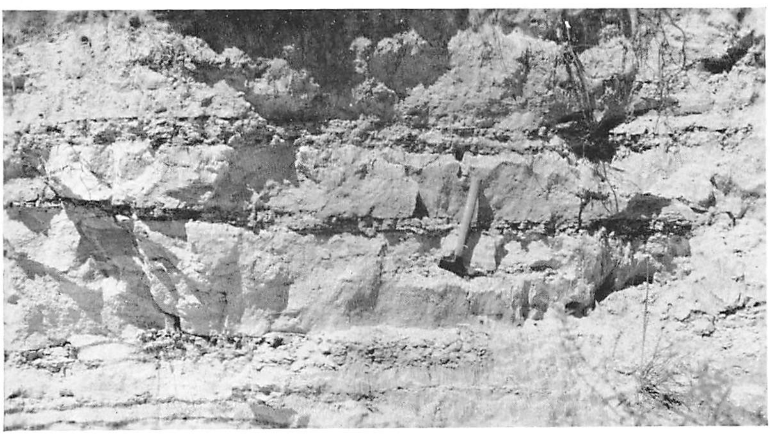

Figure 22.—Cross-bedded Pleistocene terrace sands containing clay stringers. Roadcut (Secs. 29 and 32, T. 6 N., R. 6 E.), about 3 miles southwest of Morton. August 26, 1941.

creek near the base of the hill, due south of Bishop's store, the Yazoo clay is exposed at an elevation of 425 feet beneath sands and silty clays. This exposure is also about 30 feet below the Yazoo on the hill at the east edge of town. Though these materials resemble somewhat the weathered Forest Hill sediments, the relationship to the Yazoo clay suggests terrace deposits in a Pliocene or Pleistocene stream channel across the area.

PLEISTOCENE TERRACES

Over large areas of the county deposits of late Pleistocene (?) terrace materials lie on the formations, usually at lower elevations than the terrace beds on the ridges and hilltops. These younger subaerial sediments are composed largely of fine-grained to medium-grained tan sands and silts containing scattered quartz pebbles. Thin layers and stringers of gray or tan clay, some mottled or streaked red, are common (Figures 21 and 22). At a few localities are thickened lenses of clay. Cross-bedding of sands is likewise a visible feature in some of the better exposures. At several localities to the west and to the east of Morton, along the Pulaski to Homewood road and scattered over the southern part of the county, are beds of these secondary[13] terraces.

A roadcut on a small hill ½ mile north of Pulaski exposes 4 to 6 feet of massive fine-grained argillaceous sand that truncate several feet of slightly dipping thin-bedded gray and tan silty clays and sands having laminae of clay (Figure 23). A test hole on top of the slope penetrated in succession: 4 feet of red sand; 6 feet of thin-bedded gray silty clay having yellow and red streaks; 9.5 feet of fine yellow sand containing thin layers of gray, purple streaked clay; 2.5 feet of silty gray, purple streaked clay; and Yazoo clay. The relationship of the upper red sand could not be ascertained, and though it appears like the Citronelle terrace material on the hills south and east of Pulaski, the lower deposits seem to be terrace material also, and have been mapped as such in this survey. Channeling and filling of an older terrace deposit are suggested from the exposure.

In the Claiborne region terrace deposits are extensive and obscure a great deal of the Yegua and Lisbon formations. At many places these beds are only a few feet in thickness. They are extensively exposed near Sebastapol in the northeast and in the Ludlow area of the west. South of Sebastapol thin-bedded Kosciusko clays containing leaf imprints are covered by terrace sands. Figure 2 shows part of a channel filling and covering of these beds.

Terrace sands, gravels, and recent alluvium obscure the Yegua formation in the small offset portion of the county lying between Pearl River and southwestern Leake County. The de-

Figure 23.—Massive red sand truncating inclined sand beds. Terrace deposits on a hill (NE. ¼, NE. ¼, NW. ¼, Sec. 17, T. 5 N., R. 7 E.), ½ mile north of Pulaski. August 30, 1941.

posits in this area of approximately 8 square miles have been eroded into hills of low relief and are now covered by woods and other vegetation. The terrace deposits constitute the top of the hills; the colluvial wash, the slopes; and recent alluvium, the low areas tributary to the river. The only exposures are in the river bluff. At "Coal Bluff" the lignitic Yegua beds are overlain by nearly 15 feet of cross-bedded coarse-grained brown and white sands in which quartz pebbles are scattered. Sandy yellow clay is exposed for an additional 15 to 20 feet above the sand and in part underlies the wooded hills east of the river. Sands containing scattered gravels and stringers of clay are exposed in roadcuts along the county line northwest of Ludlow and in Leake County to the north. All these deposits at the surface in this area may have originated as former terraces of Pearl River.

At many other places in the Claiborne area, particularly in regions underlain by the Yegua and the Kosciusko, it is difficult to distinguish terrace deposits from the weathered material of the older formations, consequently more detailed work needs to be done.

LATE PLEISTOCENE AND RECENT FLOODPLAIN AND ALLUVIAL DEPOSITS

The sluggish streams which now flow through the county are a contrast to the swirling rivers that rapidly transported sand and large gravel and built the extensive terrace deposits of late Pliocene and early Pleistocene. During the present cycle of erosion sands have been carried from the higher areas and spread as alluvium over the wide bottomlands, especially in the low and swampy northeastern portion. Near the high ridges and hills, alluvial fans which in part may be of late Pleistocene age, have spread over the land at lower altitude. In the vicinity of the Stage road, two miles east of the higher ridge road south of Morton, alluvial silts and sandy clays have been spread over eroded Yazoo clay areas to a depth of 12 to 16 feet. At places quartz pebbles have been scattered with the finer materials, and in some of the weathered Yazoo clays throughout the Jackson belt of Scott County, pebbles from alluvium have become so well incorporated that the semblance is one of initial deposition with the clay.

In the area west of Coffee Bogue in the northwest part of the county, a thin veneer of alluvial sand and silts, 3 to 8 feet, appears everywhere to cover the Yazoo clay except in a few small gullies.

Along Coffee Bogue, a mile-wide Yegua reentrant in the Jackson area is covered by 18 to 20 feet of clay and sands containing considerable gravel. The area to the east is higher and exposes Yazoo clays. To the west the region is nearly level, and the Jackson formation underlies thin alluvium.

Apparently during the late Pleistocene epoch, Coffee Bogue more or less filled a channel that had been cut on a gently arched surface. The stream today has cut somewhat into the floodplain and flows intermittently in a narrow belt covered by recent alluvium.

Alluvium overlies and obscures Claiborne sediments at many places in the northern part of the county. A great deal of topographic and detailed geologic work would be necessary to distinguish some of the alluvium and secondary terrace deposits from weathered Yegua and Kosciusko. Only the general distribution has been indicated on the geologic map accompanying this report.

GEOLOGIC HISTORY

The surface formations of Scott County all belong to the early Tertiary with the exception of terrace and alluvial deposits that are spread in many places over the older materials. The early Tertiary formations indicate extensive submergent and emergent conditions which determined the type of materials that accumulated as the land surface either sank beneath seas or emerged a little above the marine waters. During three divisions of the Eocene and early Oligocene, the area stood as a lowland that accumulated sands and silty clays containing large quantities of vegetable materials that grew on the marshy surface or was carried to it from areas of slightly higher altitude.

The first of the non-marine phases marks the oldest surface materials laid down in the region and obscures underlying marine sands of early Lisbon time. At places bogs must have existed in which thick vegetation accumulated that gradually carbonized to form lignite. Such conditions particularly prevailed marginal to the sea just prior to the general submergence of the land. With the marine invasion, glauconitic sands and clays were deposited. Abundant molluscan forms, chiefly gastropods, and a few corals lived in the sea, and their remains together with tests of foraminifera became buried in the deposits of the Wautubbee.

A withdrawal of this sea, due to rising land conditions, brought the area again to a lowland during Yegua time with the deposition of clays followed by fine-grained sands. In these sediments and the silty clays that covered them, lignitic materials and the imprints of leaves indicate that land vegetation grew in the region and was buried in the marshy environment.

A more extensive submergence followed this second time of subaerial conditions, and a thick accumulation of marine sediments spread over the gentle lowland surface of the sinking area. At first sand and glauconite, marking relatively shallow water conditions, were laid down. With these Moodys Branch deposits there were buried the tests of foraminifera and the shells of numerous mollusks, some entire, others broken and worn by the movement of the waters before coming to rest on the sea bottom. Some of the earliest forms burrowed into the muds and silts of the previous land surface, and sands filtered into the holes that mark their activity. This phase of deposition was geologically brief, for with further encroachment of the seas from the south a thick uniform deposit of muds gradually was added to the previous accumulations on the area. To these muds (now termed Yazoo clay) the shells of marine animals were added. In the earlier Yazoo sea oyster reefs extended over large areas. At this time and later, the bones of the large whale-like mammal *Zeuglodon* settled into the muds and preserved the best evidence of vertebrate life of that time.

Slight volcanic activity in late Yazoo time is indicated by a thin bentonite deposit in the upper clays. The thin accumulation of ash suggests that either the region of disturbance was distant from central Mississippi or the activity was of short duration.

Rising land conditions followed this mild disturbance and for a time erosive activities tended to remove part of the former deposits. This action could not have lasted long, for stream channels or other erosion scars were not developed. Instead there soon was laid down a deposit of fine sand and silts or clays containing vegetable materials, for the beds of the Forest Hill mark the opening of the Oligocene.

After the accumulation of the Forest Hill sediments, there followed again a time of submergence during which the Mint Springs marl and the Glendon limestone were laid down in the southwestern part of the county. Probably this last sea did not extend as far over previously flooded regions, for although limestone indicates a fairly deep environment of accumulation, the only remnants today are in the area south of Morton.

Sometime during late Oligocene or during the Miocene, the area was slightly folded and faulted.

The erosion during emergent Miocene time must have been very extensive, for at most places the Glendon and Mint Springs formations were entirely removed. Seas never again covered the area, but during the last of the Tertiary, or early Pleistocene the swirling streams moved great quantities of gravels and sand from regions to the north and in places rapidly built floodplains over the earlier Tertiary deposits. Large trees were brought to this environment along with the gravels and quickly covered by the sediment.

Since the early Pleistocene, erosion has constantly changed the surface features of the area. During late Pleistocene, streams cut deeply into the Yazoo clay, later building floodplain deposits on the eroded surface. Alluvial fan deposits were spread from hill regions onto surrounding low areas. Gradually the geologic agents of weathering and erosion produced the present topography of hills and "prairie," and the streams flowing away from the central part of the county became sluggish as they silted-in their bottom areas.

STRUCTURAL GEOLOGY

One interpretation of the near-surface conditions in Scott County is indicated on the accompanying structural map. The disconformity existing between the Jackson and the Yegua formations represents a change from non-marine lowland deposition to a marine sedimentation. Erosion of the Yegua does not appear to have been extensively developed prior to submergence by the Jackson sea. The contact of the two formations seems to serve as a well defined mappable surface and has been used as such in this survey.

The area contoured on the top of the Yegua indicates the regional strike of the formations and possible irregularities developed in a belt across the county. A long westward pointing anticlinal nose in the vicinity of Forest is suggested from the well data at Forest and the test holes to the north and east.

In the northern part of T.6N., R.7E., a fault, having the downthrow on the north side, is interpreted as cutting an anticlinal nose bordered by a low reentrant to the northwest.

A terraced high area is suggested by the contouring in T.7N., R.7E. A small closed high has been contoured in the nortwest corner of the same township and the northeast corner of the adjacent township to the west. Sedimentation, however, may have in part influenced these structural irregularities.

In the northwestern portion of the county the contouring indicates a long terraced anticlinal nose pointing toward the southeast in the region of the Yegua reentrant along Coffee Bogue. This gently arched area does not give surface evidence of closure but is 6 or 7 miles in length. At the north end of the structure, west of Ludlow, the northern margin of the Jackson appears to bend westward toward the county line. A structural low is in the adjacent area to the east.

Contours were drawn on the Forest Hill-Yazoo contact in the southern part of the Morton quadrangle. In this area the change was from a marine to a non-marine phase of deposition in a swampy, perhaps marginal marine, environment. A disconformity is considered to exist between the Jackson and the Forest Hill beds but erosion does not appear to have produced irregularities in Scott County. The contours on the Yazoo clay top show that a general northwesterly strike has been altered slightly so that along the southwestern part in the higher ridge area the contours are sharply flexed and bend toward the north, changing again to the west in the northern portion. A large number of test holes were drilled throughout the southern part of the Morton quadrangle to ascertain the relationship of formations. Some of the alluvial sands overlying the Jackson in the eastern part of the western townships, were at first incorrectly interpreted as belonging to the Forest Hill. Contouring of these points produced a pronounced, almost synclinal, folding in the area. Only the data which gave a definite Forest Hill-Yazoo clay contact were used on the final map.

It has been noted before in this report that the terrace deposits on the Forest Hill sediments in the southwestern part of the Morton quadrangle present a contact which is dipping very slightly toward the southwest throughout the length of exposure. This is in contrast to the dip of the Forest Hill-Yazoo clay contact and suggests that the folding in the area took place prior to the terracing, probably in Miocene time.

ECONOMIC GEOLOGY

LIGNITE

Only one bed of combustible lignite was located in Scott County. On the L. O. McClinton property (SW. 1/4, NE. 1/4, Sec. 9, T.8N., R.9E.), compact blocky lignite is exposed to a depth of 2½ feet above a small stream where it has cut into a hill. The lignite continues another foot below the surface of the water. It is slightly silty and in the upper part there are vertical borings filled with sand from the overlying bed. The lignite is also exposed in the bed of the stream for several yards toward the west. It was penetrated in a hole drilled on the hill south of the exposure, but its lateral extent was not determined. This lignite lies at the top of the Kosciusko and has been discussed previously in this report.

A 3-foot lignite bed, approximately 8 feet below the base of the Wautubbee member of the Lisbon, was found 40 feet below the surface of a test hole (Elev. 411) half-way up the slope of the hill south of the Hays community (SE. 1/4, SW. 1/4, NE. 1/4, Sec. 15, T.8N., R.9E.). Lignitic silts are common elsewhere in the Kosciusko.

The lignite of the Yegua at Coal Bluff (NW. Cor. Sec. 34, T.9N., R.5E.) in the east bank of Pearl River is too silty and high in sulphur to have much commercial value. The extent of this bed is unknown.

The Forest Hill sediments, though lignitic, do not offer any possibilities of compact lignite beds in Scott County.

BENTONITE

Bentonite is a clay formed from weathered volcanic ash and is composed of extremely minute flakes of the material montmorillonite, giving it high absorptive qualities. In montmorillonitic clays, the montmorillonite flakes are much smaller than are kaolinite flakes in kaolinitic clays that in the former clays a greater number of flakes plus a greater amount of flake surface exists. This gives montmorillonitic clays a high absorptive quality which exceeds that of kaolinitic clays by nearly 10 times.[14]

Bentonite in commercial quantities is not present in Scott County, where the only material is in the Yazoo clay. It is confined to a thin irregular bed at the top of the formation, despite the fact that the clays of the formation are nearly everywhere montmorillonitic, and X-ray analyses of some of the material in Scott County prove that montmorillonite is the clay-forming constituent.

One small exposure of impure bentonite was found at the head of a gully in the north edge of a gravel pit west of the Morton fire tower. The bentonite, which is abount 0.5 foot thick where exposed, is light-gray streaked by red and yellow clay and contains the casts and molds of small mollusks. This thin layer lies beneath a 0.7 foot layer of ocherous-yellow montmorillonitic clay which in turn is overlain by Citronelle terrace sands and gravels.

The equivalent thin bed of bentonite was found beneath Forest Hill sediments at or near the top of the Yazoo clay in several test holes in the area south and southwest of Morton. Thin layers of a creamy smooth bentonite were found in a 0.3 foot interval at the top of the Yazoo clay beneath 25 feet of Forest Hill sediments on the slope south of the road bend east of the reservoir tank in Roosevelt State Park.

A mealy cream and tan bentonite bed (0.8 foot), interlaminated with slightly arenaceous tan clay, was penetrated 6 feet below the Forest Hill sands, south of the road near the base of a slope 75 yards west of an abandoned road bend (SE. ¼, SE. ¼, SE. ¼, T.5N., R.6E.).

The occurrence of bentonite described by Bay[15] has been discussed elsewhere in this report.

None of the other formations of the county contains any bentonite. The basal Glendon limestone is represented only by residual cobbles in terrace sands at one place (SE. ¼, Sec. 17, T.5N., R.6E.) and is lower than the horizon containing the bentonite deposits in the Glendon limestone of Smith County.

SAND AND GRAVEL

The Citronelle terrace deposits of Scott County furnish an adequate amount of good sand and gravel to supply local construction and highway needs. Four pits in these deposits are located within a 2½-mile radius of Morton and have supplied large quantities of material. Three of these are along the "ridge" road south of Morton. In the William G. Walter pit (SE. ¼, NE. ¼, Sec. 27, T.6N., R.6E.) one mile south of town, a 20-foot to 30-foot thickness of gravel and sand has been removed on the west side of the road. The terrace deposits are about 40 to 50 feet thick at that locality and overlie Forest Hill sediments. The Jackson formation is about 60 feet beneath the top of the hill. The lower portion of the terrace beds contains a large amount of silty clay blocks and fine sand which is exposed in the floor of the pit (Figure 16). The gravels are scattered and lensed in the sands.

The Tip Stuart gravel pit (SW. ¼, SE. ¼, Sec. 34, T.6N., R.6E.) is in a terrace sand deposit which caps a hill 2½ miles south of Morton. The Forest Hill silts and clays are exposed in a trench in the north end of the pit (Figure 15) and indicate the limited thickness of the graveled deposits. The workings are being extended to the south and southwest following the trend of the hill but the supply will be exhausted when the terrace capping is removed.

A smaller pit south of the road forks (Middle S. ½, Sec. 27, T.6N., R.6E.) about 2 miles south of town has supplied considerable sand recently.

Opposite the Morton fire tower, 1¾ miles north of Morton, a pit has been operated since 1920 on the Adams Edgar Lumber Company property. The exposed lenticular gravel beds (Figure 19) and the white and red sand are part of an outlying Citronelle terrace deposit that caps the hill and lies on Yazoo clay. The deposit is approximately one-fourth mile long and is nearly 40 feet thick on the crest of the hill. Agate and fossiliferous chert pebbles and pieces of petrified wood are common in the gravel lenses. The associated clayey sand makes a good natural soil concrete for road surfacing.

A terrace-capped hill (W. ½, Sec. 32, T.8N., R.6E.) south of the Forest fire tower 2½ miles south of Forest has been supplying considerable sand for recent highway construction. Smaller pits have been opened on many other terrace-capped hills in the southern portion of the Forest quadrangle, particularly in the vicinity of Norris.

East of the new highway at Harperville, a pit in terrace beds exposed 15 to 20 feet of fine-grained somewhat micaceous reddish-brown to white sand. This sand contains clay pebbles and stringers that pinch out; small quartz pebbles are scattered throughout the upper part of the exposure and in places are concentrated in cylinder-like structures. No large concentration of gravels is found in this deposit but lenticular quartz and chert gravel beds are shown in a cut on the highway to the west.

Extensive deposits of sand, in part terrace, are to be found in the Claiborne belt, but in this area only the Citronelle terraces, composed of conspicuous reddish-brown sands and scattered gravels, have been mapped, though in a generalized manner, in this survey. Heavy gravel deposits appear to be lacking over the Claiborne area though there are scattered small lenses of gravel. Doubtless the undifferentiated secondary terraces and alluvial deposits over this section of the county can supply some good sands for general use.

The Citronelle terrace deposits contain the coarser sands and the lenses of chert and quartz pebbles. Pebbles are scattered in the secondary terraces and in the alluvial and colluvial deposits. The proximity of deposits available for local needs appears to have been the factor of development of those already in use. Future prospecting should be done with the knowledge that the best deposits are limited to the ridges and hills and that the deposits in the southern part of the county cap hills of Jackson clays or of Forest Hill fine-grained lignitic sands and silts.

OIL AND GAS

In 1923-24, the first oil test well in Scott County was drilled one mile south of Forest by the Mississippi Oil and Gas Trust Company Graham No. 1. It was started in the lower Jackson and abandoned at 5,240 feet in the Eutaw sands. A few gas shows were reported.

During 1940, several tests were made in the central part of the county in the area north and northeast of Morton. The first well was the Adams Edgar Lumber Company E. L. Martin No. 1, 3 miles north of Forkville, (S. ½, SE. ¼, SW. ¼, Sec. 25, T.8N., R.6E.). It was started in basal Jackson and drilled to a depth of 6,520 feet where it was abandoned in the Tuscaloosa formation.

Farther south, about 5 miles north-northeast of Morton (NE. ¼, SW. ¼, Sec. 30, T.7N., R.7E.), the Exchange-Newell Mineral Lease No. 1 was drilled and abandoned in the Tuscaloosa at 6,512 feet.

The deepest test in the State was the Gulf Refining Company well (E. L. Martin-Newell No. 1) drilled about 4 miles northeast of Morton (NE. Cor., Sec. 5, T.6N., R.7E.) to a depth of 10,365 feet (Elev. 443 feet D. F.). The depths to tops of formations, as picked and reported from electric logs, are as follows: Tallahatta, 885 feet; Wilcox, 1131 feet; Midway (Porters Creek), 3116 feet; Clayton, 3775 feet; Selma, 3780 feet; Eutaw (Blossom), 4879 feet; Tuscaloosa (Woodbine), 5283 feet; Paluxy, 6650 feet; Glen Rose, 7690 feet; Travis Peak, 9710 feet. The lower Cretaceous correlation of the last 3 formations has been made by the Cretaceous Study Group[16] of the Mississippi Geological Society who have made additional subdivisions of the Tuscaloosa formation as the result of their studies are: top of chert conglomerate zone of Tuscaloosa, 5695 feet; top of marine Tuscaloosa, 6035 feet; base of marine Tuscaloosa and top of lower massive sand section, 6250 feet. The study group have correlated the upper 400 feet of the Selma of this well with the Navarro and the remainder with the Taylor formation. They further report the Taylor portion of the Selma of Scott County wells to have water lain volcanics.

A good sand section was found in this well, which together with the fact that it ran high at depth offered encouragement for a time, and it was deepened beyond the original expectations. No oil shows were found, however. Following the abandonment of this well, the Gulf Refining Company drilled 4 core tests, 2 being north of the well, 1 to the east and 1 to the south. Activity in the area has been quiet since the abandonment of the deep test and the coring operations in test holes.

Though no oil shows were reported in these wells, it does not follow that the area has been condemned. Increased knowledge of the behavior of subsurface formations of central Mississippi and further information gained by tests in adjacent areas may again stimulate interest in Scott County. Evidence of faulting shows up on electric logs of some of the test wells and the surface work indicated this also.

In the northwest part of the county there is a long reentrant of the Yegua into the Jackson belt. This is covered by 18 to 20 feet of Pleistocene sands and gravels but appears to be a gentle uplift of an elongated anticlinal nose along a north-south direction. Though the contours do not indicate closure sufficient to signify an oil trap, the long terracing and low area to the east suggest that the area or territory adjacent merits further exploration and study.

Surface data on structural conditions could not be assembled for the Claiborne region or for the south half of the Forest quadrangle.

In the area south of Morton the contouring on the top of the Yazoo clay indicates a flexing along the region overlain by the Forest Hill and Citronelle terrace deposits in trend with the higher ridge area. This area has the highest altitude of the Morton quadrangle. No closures were indicated from these contours, so surface data are considered inadequate in regards to reflection of any structural conditions which may be existant.

CLAYS

Clay beds constitute a large percentage of the geologic formations exposed in Scott County, but commercial deposits are very limited. The ceramic data and chemical analyses obtained from outcrop and test hole samples permit some generalization of the economic value of the clays of individual geological formations. This information indicates that the best possibility of commercial development is that of brick and tile clays from Citronelle terrace deposits and from the Forest Hill formation in the southwestern part of the county.

The clay beds in the Citronelle formation or other terrace deposits are erratic and restricted. They are apt to be lenticular and thin laterally. Only one deposit merited consideration—that on the Henry Stuart property (NW.¼, Sec. 21, T.5 N., R.6 E.) and adjacent land near the Ridge Road, 6½ miles south of Morton. Clay is exposed in gullies near the Stuart house and, on the hillside east of the Ridge Road, in gullies in a pasture and the bed of a stream. Test holes indicated the clay beds do not extend much beyond the exposure in the gully north of the house but underlie one or two acres of land to the south and east. The maximum thickness determined by drilling is approximately 14 feet, but the deposit thins laterally and may be erratic in the area. In places thin sand layers separated the clay into beds 5 and 6 feet in thickness. The clay obtained on the Stuart property is principally of the light-weight variety high in silica and low in lime, magnesia, and iron. McCutcheon considers it suitable for light-colored face brick, building block, and partition tile, though some of it burns to a darker color and is more suitable for common brick, hollow and drain tile. The deposit is accessible to a good road and the overburden is not too great for easy removal by stripping.

The clay beds of the Forest Hill formation are more extensive than the terrace clays, but over most of the area they are covered by alluvial sands from the Citronelle. The beds appear to be fairly persistent laterally, and thicknesses of 5 to 18 feet were penetrated in test holes over the area. These clays are likewise non-marine, and thin layers of sand lens into the clay and separate the deposits into thin beds at some places. The most accesible beds are on the Hilton Stuart property (Sec. 20, T.7 N., R.6 E.) where there are exposures of chocolate-brown smooth to silty clay in several small gullies in fields and pastures south of the road. The exposed clays have been considerably weathered. Chemical analyses of Forest Hill clay samples (J21-2 and J41-3) indicate that the properties are similar to those of the Citronelle clays. The presence of lignite in the Forest Hill clays is not deleterious, because it burns off during firing.

Basal Forest Hill clays are exposed in west Morton in a small gully on the hillside south of the Shell Oil Company filling station located on U. S. Highway 8. The clays are silty and chocolate brown with imprints of leaves. The chemical analysis of a sample (J171-1) shows the similarity of this clay to beds that are stratigraphically higher in the Forest Hill formation and situated several miles south of Morton. The deposit in Morton seems to be too small for commercial consideration.

Weathered and unweathered Yazoo clays were sampled and tested. The data obtained confirm findings elsewhere in the

Jackson belt; namely, that the formation has little economic value at present, but future needs may bring about the utilization of some of these clays exposed over such a wide belt across the state. The Yazoo clay is usually highly calcareous and does not yield a good burning clay. The high lime content in the unweathered clay is due largely to the abundant foraminifera and mollusk shells. Finely granular marcasite is also present. Gypsum is formed as a product of weathering, and the crystals may be abundant along joints and concentrated in lenticular streaks in the clay. The presence of gypsum ($CaSO_4.2H_2O$) causes disruption of the clay during burning.

In the central prairie belt, the Yazoo clays have been extensively leached by weathering and the upper residual tan clays are somewhat mixed with fine alluvial silt. Leaching has lowered the lime content and the greater concentration of silica with additions from the silt gives this clay properties suitable for common brick, drain tile, and hollow partition tile. Most frequently, however, the weathered clays contain gypsum or iron carbonate and would be undesirable for ceramic usage. An example is a tan colored weathered upper Yazoo clay exposed in a gully at the north end of a gravel pit 1¾ miles north of Morton. The clay is montmorillonitic as shown by X-ray. Iron oxide stains and concentrations of gypsum along joints have formed by weathering. An analysis of this clay (J4-5), freed from gypsum, shows 51.65 percent silica, 22.96 percent alumina, and 1.11 percent lime.

In the unweathered greenish-gray clays and the slightly weathered clays of the lower Yazoo, the lime and silica contents of some of the samples analyzed ranged from 25 percent to 30 percent for each of these constituents. It appears to be of no value for ceramic usage, except where silt has been added to the weathered clay, and then only when gypsum is not present. The clay, however, does offer some potential value for rock wool when mixed with lime and sand and from previous tests on the Yazoo clay of Yazoo County, McCutcheon[17] states, "The particular uses considered favorable are: (1) as a bleaching clay, (2) as a bond in molding sand, (3) as a drilling mud, (4) as a raw material for the manufacture of light-weight aggregate for concrete, and (5) as a beneficial filler in fertilizer."

In the Yegua belt the clay beds are thin and are extensively covered by sands. The clay is generally silty and lignitic, dark gray where unweathered but chocolate brown where the beds are near the surface. Gypsum is present in some deposits and excludes the ceramic use of such clays. Ceramic data indicate that some of the clay is suitable for brick and tile use, but the two localities tested are poorly located for transportation, and the deposits may not be extensive enough for development though the overburden is only a few feet thick. Analyses show that the chemical properties of the weathered Yegua clay are much like those of the terrace deposits. Most of the Yegua belt in this county, however, is of little economic value because of the usual heavy sand covering or poor location of the clay deposits with reference to transportation.

The marine Wautubbee clays offer little ceramic value, though weathered deposits of two localities yielded clay suitable for common brick, hollow tile, and drain tile. These deposits may be too limited for utilization. One is a 5-foot bed of silty chocolate-brown clay laminated by white silt that is exposed west of the road in a gully on a hillside on the A. W. Harkey property (NW. ¼, SE. ¼, SE. ¼, Sec. 9, T.8 N., R.8 E.). This deposit is underlain by 5.5 feet of clay-silt.

Near the highway at a point 1½ miles northeast of the main tributary of Tuscolometa Creek, a test hole on the M. Bolware property (NE. ¼, NE. ¼, NW. ¼, Sec. 22, T.9 N., R.8 E.) revealed 8.7 feet of light tan to chocolate-brown silty micaceous clay speckled by white particles of echinoid (?) spines. The ceramic tests indicate the clay has an application similar to the clay on the Harkey property. Some of the other Wautubbee clays tested were of no economic value.

Kosciusko clays were not tested, being too thinly bedded and too silty to warrant sampling. Many samples of clays other than those described in this report were taken at various localities. Some were culled because the inclusion would have meant needless repetition. A few were unintentionally overlooked by the ceramic department. Records of all test holes showing logs and samples are on file at the offices of the State Geological Survey. Several hundred samples were collected for paleontologic and stratigraphic study and have been placed on file.

TEST HOLE RECORDS

ADAMS EDGAR LUMBER CO. PROPERTY

TEST HOLE J4

Location: T.6 N., R.6 E., Sec. 11, SW.1/4, SE.1/4, NW.1/4. At head end of a small gully at north end of a gravel pit west of Morton fire tower.

Drilled: June 14, 1940

Elevation: 540 feet ± Water level: 4.0 feet

No.	Depth	Thick.	Description of strata
			Alluvium from Citronelle formation
1	0.8	0.8	Sand and gravel
			Yazoo clay (Top)
2	1.5	0.7	Clay, plastic ocherous-yellow; basal 0.2 feet mottled red; S-2
3	2.1	0.6	Bentonite, gray streaked yellow and red clay; contains casts and molds of pelecypods; S-3
4	6.9	4.8	Clay, smooth plastic ocherous-yellow; lighter gradation of color near base; casts and molds of mollusks and white silty remnants of *Textularia mississippiensis* Cushman ?; P-4
5	13.0	6.1	Clay, smooth gray (greenish cast when moist); contains white silt remnants of *Textularia mississippiensis* Cushman ?; scattered gypsum and iron oxide streaks; P-5
6	18.0	5.0	Clay, gray; streaks of chalky mollusk shell fragments and abundant foraminifera; S-6

Remarks: Hole drilled at base of Citronelle sands and gravels; Samples P-4 and P-5 taken from gully in which beds 1 to 5 are exposed.

Henry Stuart Property

Section and Test hole J5A

Location: T.5 N., R.6 E., Sec. 21, SW.1/4, NE.1/4, NE.1/4. In a stream bed in a gully east of the Ridge Road and 2.2 miles south of road fork.

Drilled: Oct. 18, 1940

Elevation: 605 feet ± Water level: surface

No.	Depth	Thick.	Description of strata
			(Section exposed in gully)
			Citronelle formation
1	41.0	41.0	Sand, coarse-grained brick-red; scattered quartz pebbles; some cross-bedding
2	47.0	6.0	Clay-silt, thinly laminated micaceous gray to light-tan; iron oxide stains and mottlings; limonitic encrustations at contact with sands; upper surface irregular (up to 4 feet thicker in places)
3	48.0	1.0	Clay, smooth blocky light-tan; iron oxide stains along joints; P-3
			(Test hole)
4	62.0	14.0	Clay-silt; (like that of bed No. 2 in exposure)
			Forest Hill formation ?
5	64.0	2.0	Silt and fine-grained sand, bluish-gray

Remarks: P-3 sampled largely for comparison with heavy clay beds elsewhere on property. Hole dug in bottom of the gully in bed No. 4 and abandoned in the fine sand and silt. Measurements were made up gully to road by hand level.

HENRY STUART PROPERTY

TEST HOLE J6

Location: T.5 N., R.6 E., Sec. 21, NW.1/4, NW.1/4, SE.1/4. Between two small gullies near base of ridge at a point 75 yards south of a wagon road and approximately 180 yards east of the Ridge Road.

Drilled: June 19, 20, 1940

Elevation: 553 feet — Water level: 14.7 feet

No.	Depth	Thick.	Description of strata
			Citronelle formation
1	2.0	2.0	Sand, reddish-brown; thin clay layers; scattered quartz pebbles
2	4.2	2.2	Clay, very silty gray streaked by yellow iron oxide; S-2
3	7.4	3.2	Clay, smooth gray laminated by white silt; small lenses of white and yellow silt; P-3
4	16.0	8.6	Clay, extremely silty gray streaked by yellow iron oxide; S-4
5	23.6	7.6	Clay, very silty dark-gray partly streaked by tan iron oxide; abundant thin laminae of white silt; S-5
6	30.0	6.4	Clay, light-gray; streaks and layers of white and brown silt; S-6
7	32.0	2.0	Silt and clay; tan and white, some pink mottlings; streaks and layers of fine yellow sand and white silt; occasional ferruginous concretion; S-7
8	34.3	2.3	Clay, pink and gray interbedded with thin layers of ferruginous silt; S-8

Remarks: P-3 sampled from gully exposure.

Henry Stuart Property

Test hole J8

Location: T.5 N., R.6 E., Sec. 21, SW.1/4, NE.1/4, NW.1/4. Head end of gully 50 yards north of the Stuart house. Drilled: June 17, 1940

Elevation: 575 feet ± Water level: 6.0 feet

No.	Depth	Thick.	Description of strata
			Citronelle formation
1	2.9	2.9	Sand, fine-grained ferruginous
2	8.1	5.2	Silt, clay mixed; streaked by red and yellow iron oxide, especially in upper part; S-2
3	13.1	5.0	Clay, silty slightly micaceous light-gray; streaked by red and yellow iron oxide; P-3
4	13.5	0.4	Sand, yellow medium to fine
5	15.0	1.5	Clay, sandy light-gray; streaked tan
6	21.0	6.0	Clay, gray; streaked or mottled tan except in lower 2 feet; white or tan silt in thin layers and lenses in most of the bed at widely separated intervals; P-6
7	27.1	6.1	Sand, medium-grained yellow; intensity of color increasing in depth
8	33.9	6.8	Clay, silty light-gray to white mottled yellow; widely separated thin lignitic streaks. Interval includes a yellow sand layer from 31.1 to 31.3 feet; P-8
9	34.0	0.1	Sand, fine-grained gray
10	37.5	3.5	Clay, silty; predominantly red in uppermost one foot, grading to light-gray in lower part; C-10

Remarks: Because of sand caving and contamination P-3 and P-6 were resampled in dry weather on October 17, 1940 and substitution of samples made.

Henry Stuart Property

Test hole J8B

Location: T.5 N., R.6 E., Sec. 21, NW.1/4, SE.1/4, NW.1/4. In ditch near gum tree 50 yards south of the Stuart house.

Drilled: October 17, 1940

Elevation: 570 feet

Water level: 21.0 feet

No.	Depth	Thick.	Description of strata
			Citronelle formation
1	15.4	15.4	Sand, medium-grained reddish-brown grading to yellow at 14.0 feet. A layer of ferruginous cemented sand at 14.2 to 14.4 feet.
2	18.8	3.4	Clay and sand mixed; dominantly yellow, minor white areas
3	32.4	13.6	Clay, somewhat silty gray to tan or having one color streaked in the other; thin tan silt layers and small limonitic nodules in lower 10 feet; a layer of fine-grained white sand at 23.1 to 23.4 feet; P-3

Remarks: Sand layer not included in Sample P-3.

HENRY STUART PROPERTY

TEST HOLE J8C

Location: T.5 N., R.6 E., Sec. 21, NE.1/4, SW.1/4, NW.1/4. In gully 200 yards northwest of the Stuart house. Drilled: August 5, 1940

Elevation: 552 feet Water level: 13.0 feet

No.	Depth	Thick.	Description of strata
			Citronelle formation
			(Exposed)
1	3.3	3.3	Loam and weathered tan silty clay
2	5.1	1.8	Clay, silty weathered gray to light-tan mottled by a darker shade; surface mostly broken into inch size or smaller blocks, joints stained by iron oxide
3	9.7	4.6	Clay, smooth uniform light-gray to tan massive; 4 to 6 inch layers; conchoidal fracture fairly well developed; iron oxide stains along fractures, joints and between massive layers; tiny impressions of possible plant remains scattered throughout; some small patches and streaks of white silt; P-3
4	11.4	1.7	Clay, silty light-gray to yellow where heavily stained by iron oxide; thinly bedded with thin sand layers; tiny impressions of plant remains throughout
			(Unexposed)
5	1.6	1.6	Sand, medium-grained interlaminated white and tan
6	5.6	4.0	Clay, silty white laminated by yellow silt; S-1
7	6.2	0.6	Sand, fine-grained gray stained yellow and pink; thin streaks of clay
8	8.3	2.1	Clay, silty light-gray; streaks of fine-grained yellow sand and white silt; S-2
9	9.4	1.1	Clay, slightly micaceous silty gray; finely comminuted lignitic (?) material and laminae of white silt; S-3
10	11.8	2.4	Clay, very silty light-gray; streaks of yellow silt; S-4
11	12.2	0.4	Sand, fine-grained yellow and gray; contains some gray clay
12	13.7	1.5	Clay, silty gray streaked by yellow sand and lignite
13	14.4	0.7	Sand, medium-grained light brown
14	15.3	0.9	Clay, smooth slightly silty pink; subordinate layers of gray; S-5
15	18.0	2.7	Clay, very silty light-gray; thin laminae of fine-grained ferruginous sand and silt; S-6

Remarks: First 4 beds exposed in sidewall of gully. No. 1 bed begins 17 feet below surface of Hole No. 8. Abandoned because of rock.

Hilton Stuart Property

Test hole J19

Location: T.7 N., R.6 E., Sec. 20, NE.1/4, SW.1/4. SE.1/4. In large gully 10 yards west of rail fence and 20 yards north of slab fence 3/4 mile south of the Stuart house. Dug: June 27 and 28, 1940

Elevation: 500 feet Water level: Dry

No.	Depth	Thick.	Description of strata
			Citronelle formation
1	3.0	3.0	Sand, medium-grained to coarse-grained ferruginous; contains some clay
			Forest Hill formation
2	7.0	4.0	Clay, silty gray stained in part by iron oxide; thin ferruginous silt and cemented partings; P-2
3	11.0	4.0	Clay, smooth chocolate-brown; thin white silt lenses and partings of ferruginous silt; conchoidal fracture in some of the clay; P-3

Remarks: Sampled in pit dug in gully. Clay changes at 11 feet into clay-silt containing poorly preserved leaf imprints.

W. G. Cooper Property

Test hole J21

Location: T.5 N., R.6 E., Sec. 15, SE.1/4, SE.1/4, NW.1/4. In cut-off north of road fork. Drilled: June 28, 1940

Elevation: 456 feet Water level: 15.0 feet

No.	Depth	Thick.	Description of strata
			Alluvium
1	6.7	6.7	Sand, fine-grained white and yellow mixed; streaks of clay
			Forest Hill formation
2	16.0	9.3	Clay, silty gray to reddish-brown; thin layers of gray and yellow silt; P-2
3	25.5	9.5	Clay, chocolate-brown silty; interbedded with black sticky clay containing lignite particles and some associated fine-grained pyrite; P-3
4	26.5	1.0	Sand, fine-grained; bluish-gray when wet

Remarks: Hole caved and abandoned. Redrilled and sampled Oct. 21, 1940.

JOHN STUART PROPERTY

TEST HOLE J22

Location: T.5 N., R.6 E., Sec. 20, NW.1/4, SE.1/4, NW.1/4. On hillside, 10 feet from a gully and 150 yards west of Ridge Road. Approximately 50 feet below road. Drilled: July 2 and 9, 1940

Elevation: 554 feet ± Water level: 12.0 feet

No.	Depth	Thick.	Description of strata
			Citronelle formation
1	7.3	7.3	Sand, medium-grained gray to tan; thin clay layers
2	9.0	1.7	Clay, silty tan
3	11.2	2.2	Clay, sandy yellow to gray; thin layers of white sand at intervals
4	18.5	7.3	Clay, very silty gray; ferruginous silt streaks in upper 3 feet, remainder uniform and very sticky when wet, crumbly when dry; a layer of fine yellow sand* at 16.3 to 16.6 feet; P-4
5	24.8	6.3	Clay, smooth silty dark-gray; laminated by white silt; P-5
6	25.5	0.7	Clay, dark-gray laminated by fine-grained white sand
7	25.7	0.2	Sand, brown medium-grained; contains a thin layer cemented by iron oxide
8	27.8	2.1	Clay, silty gray; scattered green grains; hard sandy layers at intervals
9	29.0	1.2	Sand, medium-grained to fine-grained gray; yellow streaks
10	29.8	0.8	Clay, silty gray laminated by white silt
11	32.5	2.7	Sand, fine-grained gray interlaminated with bluish-gray clay.

Remarks: *Sand not included in sample P-4. P-4 and P-5 resampled in dry weather, October 18, 1940.

Hilton Stuart Property

Test hole J24

Location: T.5 N., R.6 E., Sec. 20, NE.1/4, SW.1/4, SE.1/4. At a point between two gullies 1/2 mile southwest of the Stuart house and 150 yards east of a field. Drilled: July 5 and 8, 1940

Elevation: 490 feet ± Water level: 11.3 feet

No.	Depth	Thick.	Description of strata
			Citronelle formation or alluvium
1	0.5	0.5	Sand, coarse red and yellow mixed
2	7.7	7.2	Clay, silty gray, tan and red mottled; grades into less weathered and mottled phase in lower two feet; P-2
3	13.4	5.7	Clay, silty gray mottled by iron oxide; minor streaks of fine gray and yellow sand and a layer of medium-grained to coarse-grained gray sand at 11.3 to 11.7 feet; C-3
4	16.3	2.9	Clay, sandy blue-gray
5	17.2	0.9	Sand, medium-grained yellowish-brown
			Forest Hill formation
6	22.5	5.3	Clay, uniform, plastic dark-gray; cuts waxy when somewhat dry. Thin layers of fine gray sand; streaks of fine-grained pyrite; P-6
7	26.2	3.7	Sand, coarse-grained gray; contains pieces of hard ferruginous sandstone
8	30.8	4.6	Clay, silty gray to black; thin layers of lignite, some encrusted by streaks of fine-grained pyrite; minor streaks of silt and fine-grained sand at intervals; C-8

Remarks: P-2 and P-6 re-sampled October 21, 1940 in dry weather.

Hilton Stuart Property

Test hole J25

Location: T.5 N., R.6 E., Sec. 20, NE.1/4, SW.1/4, NE.1/4. In gully at west edge of field and 120 yards south of the road.

Drilled: Oct. 21, 1940

Elevation: Approximately 500 feet Water level: 24.0 feet

No.	Depth	Thick.	Description of strata
			Citronelle formation ?
1	4.5	4.5	Sand, medium-grained ferruginous; contains cemented limonitic layers
2	7.0	2.5	Clay, silty gray stained yellow and red along jointing; interbedded with ferruginous sand
3	13.0	6.0	Clay, crumbly gray stained red and yellow along joints; laminated at intervals by white micaceous silt; small lenses of coarse white sand scattered throughout; P-3*
			Forest Hill formation
4	20.3	7.3	Clay, smooth blocky dark-gray to brown; disseminations of lignite with associated fine-grained pyrite and some mica; minor streaks of gray silt; P-4*
5	20.6	0.3	Clay, smooth black; contains finely disseminated lignite
6	22.2	1.6	Sand, medium-grained yellow
7	24.5	2.3	Clay, very sandy lignitic black and gray mixed
8	35.9	11.4	Clay-silt, black drying to gray; contains finely comminuted lignite

Remarks: *Sampled from pit dug in gully. Hole started at bottom of pit in bed No. 4, 16 feet below surface rim of gully.

U. S. Government Property

Test hole J27

Location: T.5 N., R.6 E., Sec. 15, near corner SW.1/4, SE.1/4, SE.1/4. Beside fence on north side of roadcut, 100 yards east of road corner.

Drilled: June 28, 1940

Elevation: 417 feet Water level: 22 feet

No.	Depth	Thick.	Description of strata
			Forest Hill formation ?
1	12.4	12.4	Silt and fine sand, gray and tan streaked; thin laminae of brown clay
			Yazoo clay
2	25.0	12.6	Clay, greenish-gray calcareous; upper 2 feet weathered tan; contains abundant ostracods, foraminifera and mollusk shell fragments; P-2

JIM REGIONS PROPERTY

TEST HOLE J41

Location: T.5 N., R.6 E., Sec. 9, NE.1/4, NE.1/4, SE.1/4. Northwest of the Region house at a point 25 feet north of a gully and 100 yards east of Ridge Road. Drilled: Aug. 7, 8 and 12, 1940

Elevation: 512 feet Water level: 9.8 feet

No.	Depth	Thick.	Description of strata
			Citronelle formation
1	14.4	14.4	Sand, coarse brown; contains a few pebbles; grades into medium-grained yellow sand
2	17.7	3.3	Sand, medium-grained yellow and gray; thin streaks of clay throughout
			Forest Hill formation
3	22.0	4.3	Clay, silty slightly micaceous dark-gray; very plastic when wet; contains thin streaks of white silt and finely disseminated lignite; P-3
4	23.1	1.1	Clay, very silty slightly micaceous dark-gray due to finely comminuted lignite; S-1
5	23.7	0.6	Clay, silty brown streaked blue-gray
6	26.0	2.3	Sand, fine-grained gray; contains some silty gray clay
7	27.7	1.7	Lignite, black silty; some thin solid layers; S-2
8	30.8	3.1	Silt and clay, slightly micaceous light-gray; S-3
9	31.3	0.5	Lignite, laminated by dark-brown silty clay
10	32.4	1.1	Clay, silty slightly micaceous dark-gray; streaks of lignitic material and associated fine granular marcasite; thin laminae of white silt; S-4
11	33.8	1.4	Clay, smooth gray; dries to a greenish surface tinge; fine granular marcasite in minute streaks and thin laminae of white silt occur throughout; S-5
12	38.3	4.5	Sand, fine-grained gray and light-green

Casper Ueltchey Property

Test hole J85

Location: T.5 N., R.6 E., Sec. 11, SW.1/4, NW.1/4, NE.1/4. In gully near cedar trees on hillside 200 yards southwest of the Ueltchey house.

Drilled: Oct. 22, 23, 1940

Elevation: 440 feet

Water level: dry

No.	Depth	Thick.	Description of strata
			Alluvium
1	2.0	2.0	Sand, medium-grained brownish-red
			Yazoo clay
2	18.6	16.6	Clay, smooth calcareous tanish-gray, minor streaks of brown; abundant foraminifera and fragments of mollusk shells; small amount of gypsum; P-2
3	39.4	20.8	Clay, smooth calcareous greenish-gray, occasional brown streak in upper part; foraminifera and mollusk shell fragments extremely abundant; fine granular pyrite streaks scattered throughout the bed; P-3 (18.6-24.6 feet), P-4 (24.6-39.4 feet)

J. A. Copeland Property

Test hole J85A

Location: T.5 N., R.6 E., Sec. 11, SW.1/4, NE.1/4, NE.1/4. Gully in pasture at a point 1/4 mile southwest of road and 0.1 mile east of the Copeland house.

Dug: October 23, 1940

Elevation: 440 feet ±

Water level: dry

No.	Depth	Thick.	Description of strata
			Yazoo clay
1	11.3	11.3	Clay, weathered tan; mealy at surface; contains a few scattered quartz pebbles and thin lenses of sand; occasional sideritic concretion; foraminifera and calcareous nodules in lower part; P-1

Remarks: Clay reworked and mixed with alluvium.

U. S. GOVERNMENT PROPERTY

TEST HOLE J86

Location: T.8 N., R.6 E., Sec. 25, NW.1/4, NW.1/4, NW.1/4. Thirty feet west of road at a point 1/4 mile south of the Forkville fire tower.

Drilled: October 9, 14-16, 1940

Elevation: 386 feet

Water level: dry

No.	Depth	Thick.	Description of strata
			Lower Yazoo clay
1	1.8	1.8	Clay, silty gray-tan streaked brown; loamy at surface
2	6.5	4.7	Clay, silty tan; some thin streaks of brown and white silt; iron oxide streaks at intervals; P-2
3	10.5	4.0	Clay, brown to nearly black; considerable iron oxide; some streaks of white lime with associated foraminifera in lowest part of bed; P-3
4	24.3	13.8	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 ostracods abundant; P-4
5	49.5	25.2	Clay, tough smooth calcareous greenish-gray; streaks of fine granular marcasite; abundant foraminifera and ostracods; some glauconite in lowest 2 feet; P-5a and P-5b

Remarks: Abandoned at 46.4 feet but offset exploratory hole drilled to 67 feet with spiral soil auger in March. Yegua contact estimated at 70 feet. Water level 0.5 foot.

Note: In the "Tests," Sample P-4 was limited to the upper 7.8 feet of bed 4, and composite Sample P-5-7 was formed of the lower 6 feet of bed 4 and of the upper 11.0 feet (Sample P-5a) of bed 5.

D. Dumas Property

Test hole J88

Location: T.8 N., R.7 E., Sec. 5, NE.1/4, NW.1/4, SE.1/4. West bank of roadcut on south side of hill at a point 100 yards southwest of road T.
Drilled: Oct. 10, 1940

Elevation: 5 feet above road level. Water level: 15.8 feet

No.	Depth	Thick.	Description of strata
			Yegua formation
1	3.0	3.0	Sand and clay mixed; light-tan streaked and mottled by reddish-brown iron oxide
2	8.8	5.8	Clay, smooth gray to brownish-gray; iron oxide streaks in upper 2 feet and stains along joints in lower part, especially noticeable in exposed portion in roadcut. Thin layers or lenses of white silt in a few places; aggregates of long acicular selenite crystals throughout; P-2
3	10.2	1.4	Sand, fine-grained ferruginous interbedded with clay; S-1
4	15.8	5.6	Clay, very silty brownish-gray to a chocolate-brown, in places marked by tan iron oxide; P-4
5	21.3	5.5	Silt and fine-grained sand, grading from chocolate-brown in upper foot to a dark-gray and black in remainder; micaceous and lignitic; S-2
6	23.3	2.0	Silt and clay, very lignitic micaceous dark-gray to black; S-3

R. C. BAKER PROPERTY

TEST HOLE J89

Location: T.7 N., R.6 E., Sec. 23, near edge of NE.1/4, SE.1/4, NE.1/4. A point on the slope north of the barn, 75 yards northwest of the house, and 20 feet east of fence. Drilled: Oct. 14 and 16, 1940

Elevation: 385 feet Water level: 13.0 feet

No.	Depth	Thick.	Description of strata
			Yazoo clay (basal part)
1	6.2	6.2	Clay, calcareous light-tan, minor streaks of iron oxide; abundant foraminifera and ostracods; P-1
2	38.5	32.3	Clay, calcareous greenish-gray; tan streaks in upper 6 feet; crumbly and highly fossiliferous (abundant foraminifera, ostracods, and small mollusk shells); glauconitic in basal 5 feet; P-2 and P-3

Remarks: Hole begun 3 feet below *Ostrea trigonalis* bed; abandoned because of limestone nodules. Later data show that the Yegua contact is at 51 feet and basal 5 feet of above log probably belongs in Moodys Branch marl.

WILL MILES PROPERTY

TEST HOLE J91

Location: T.5 N., R.7 E., Sec. 16, west edge SW.1/4, NW.1/4, SW.1/4. In a gully north of the road on a west-facing hillside 1/4 mile east of Robinson Creek. Drilled: October 22, 1940

Elevation: 418 feet Water level: Dry

No.	Depth	Thick.	Description of strata
			Alluvium
1	4.5	4.5	Sand, fine-grained to medium-grained ferruginous; clay mixed. Exposed in bank of gully
			Yazoo clay
2	28.8	24.3	Clay, tan mottled in upper part by brown and reddish-brown; streaked in places by brown granular gypsum and by the clear crystalline variety; foraminifera and chalky mollusk shell fragments throughout; casts and molds of mollusks abundant; layer of greenish-gray unweathered clay at 23.2 feet to 23.7 feet; P-2
3	34.8	6.0	Clay, calcareous smooth unweathered greenish-gray; contains abundant foraminifera and mollusk shells; C-3

J. A. CALDWELL PROPERTY

TEST HOLE J92

Location: T.8 N., R.8 E., Sec. 3, NW.1/4, NE.1/4, NW.1/4. On north slope of hill near county line at a point 100 yards south of "Bens Place."

Drilled: Oct. 30, 31, 1940

Elevation: ? Water level: dry

No.	Depth	Thick.	Description of strata
			Colluvium
1	2.5	2.5	Clay, silty red, yellow, and gray
			Wautubbee member of Lisbon formation
2	6.5	4.0	Clay, silty chocolate-brown mottled in upper part by yellow and red; minor streaks of silt; scattered gypsum crystals; P-2
3	16.0	9.5	Sand, tan fine-grained glauconitic; contains gastropod and pelecypod shell fragments, foraminifera, and spines of echinoids; specimen of *Flabellum* sp. found; S-3
4	22.5	6.5	Sand, argillaceous fine-grained dark with lighter streaks; contains a few mollusk shell fragments, echinoid spines, and foraminifera; scattered grains of glauconite and some gypsum; S-4a and S-4b
5	26.4	3.9	Clay, gray arenaceous, glauconitic, and gypsiferous; contains foraminifera and fragments of mollusk shells; lower foot more silty and marly; S-5a and S-5b

A. W. Harkey Property

Test hole J97

Location: T.8 N., R.8 E., Sec. 9, NW.1/4, SE.1/4, SE.1/4. Small gully 200 yards west of road. Drilled: Oct. 31, 1940

Elevation: 343 feet Water level: Dry

No.	Depth	Thick.	Description of strata
			Wautubbee member of Lisbon formation
1	3.5	3.5	Sand, fine-grained to silty tan; silty clay streaks
2	9.0	5.5	Clay, silty chocolate-brown laminated by micaceous white silt; impressions of a few mollusks; mollusk or worm borings in certain thin silt-clay layers; P-2
3	14.5	5.5	Clay-silt, dark-gray to black streaked by gray and dark-green sand; S-3
4	21.6	7.1	Sand, fine-grained glauconitic dark greenish-gray to black mixed with slightly calcareous clay; minor streaks of white clay-silt; disseminated pyrite and glassy quartz throughout; S-4

Remarks: P-2 sampled from pit in gully.

J. J. Fountain Property

Test hole J100

Location: T.7 N., R.8 E., Sec. 21, SE. cor. NE.1/4, SE.1/4, NW.1/4. At edge of grove on east-facing slope north of small branch; 250 yards east of state highway. Drilled: Nov. 1, 1940

Elevation: 415 feet ± Water level: Dry

No.	Depth	Thick.	Description of strata
			Alluvium
1	6.0	6.0	Silt and fine-grained sand, yellow and reddish-brown; white streaks
2	13.0	7.0	Silt and fine-grained ferruginous sand, interbedded with thin layers of gray and light-tan clay; S-2
			Yegua formation
3	23.8	10.8	Clay, silty lignitic dark-gray to black; thin laminae of white silt at intervals in the lower portion; P-3

A. A. McCraw Property

Test hole J106

Location: T.8 N., R.8 E., Sec. 4, near middle of west edge of NE.1/4. At a point 25 feet south of the road on west slope above small branch 1/2 mile northwest of road junction with Highway 35.

Drilled: Nov. 14 to 16. 1940

Elevation: ?

Water level: Dry

No.	Depth	Thick.	Description of strata
			Wautubbee member of Lisbon formation
1	1.5	1.5	Sand, fine-grained tan and gray
2	6.8	5.3	Clay and fine-grained sand interbedded. Clay glauconitic smooth to silty tan. Sand fine-grained glauconitic; highly oxidized and streaked tan; S-2
3	16.5	9.7	Clay, slightly calcareous silty brown; somewhat gypsiferous; contains bits of weathered mollusk shells and foraminifera; C-3
4	20.8	4.3	Clay and silt interbedded. Silt, tan calcareous, gypsiferous, and glauconitic, bearing foraminifera. Clay, dark-brown, slightly calcareous and glauconitic, containing embedded mollusk shell fragments and small lenses of gypsum; P-4
5	24.0	3.2	Sand, fine-grained glauconitic and slightly micaceous heavily weathered brown; contains bits of mollusk shells and abundant foraminifera; S-5
6	26.6	2.6	Clay-silt, glauconitic dark gray; fragmentary bits of mollusk shells, foraminifera, and echinoid spines; bits of gray limestone at bottom of hole

Remarks: P-4 taken from pit dug in gully. A 4-foot clay bed lies above the glauconitic sand in which well preserved mollusk shells were found.

WALTER McCAN PROPERTY

TEST HOLE J117

Location: T.8 N., R.9 E., Sec. 2, near center of W.1/2 of E.1/2. In ditch below sand embankment on north side of the road at a point 1/2 mile southwest of Sebastopol and 100 yards west of a house.

Drilled: Nov. 27, 28, 1940

Elevation: 405 feet

Water level: 24.5 feet

No.	Depth	Thick.	Description of strata
			Terrace (Pleistocene ?) deposits
1	7.0	7.0	Sand, fine-grained yellowish-tan
2	12.1	5.1	Sand, fine-grained yellowish-tan streaked red and gray; contains thin laminae of gray clay
3	16.0	3.9	Clay, silty micaceous gray; thin partings of white and reddish or tan silt give a streaked and mottled effect; P-3
4	25.0	9.0	Sand, fine-grained yellowish-tan; streaks of gray
			Kosciusko member of Lisbon formation
5	38.0	13.0	Silt, somewhat argillaceous, micaceous gray; streaks of finely comminuted lignitic material; S-5
6	40.0	2.0	Silt, micaceous gray; white ashy silt partings between streaks of black crumbly lignite; S-6
7	51.7	11.7	Clay-silt, micaceous thinly laminated gray; fine disseminations of lignitic material throughout; some thin streaks of granular pyrite; S-7

Remarks: First 3 beds in road embankment. Hole begun at road level.

M. BOLWARE PROPERTY

TEST HOLE J118

Location: T.9 N., R.8 E., Sec. 22, SW.1/4, NE.1/4, SW.1/4. Approximately 15 feet west of roadcut through a small hill. Drilled: Nov. 28, 1940

Elevation: 464 feet Water level: 27.0 feet

No.	Depth	Thick.	Description of strata
			Wautubbee member of Lisbon formation
1	0.6	0.6	Sand, fine-grained grayish-tan
2	3.0	2.4	Clay, silty gray and tan mottled red
3	11.7	8.7	Clay, silty micaceous light-tan to chocolate-brown speckled by white particles (echinoid spines ?)*; P-3
4	20.0	8.3	Sand, fine-grained to silty micaceous; grayish-tan to tan and greenish-tan depending on amount of oxidation or glauconite content; S-4
5	25.0	5.0	Clay, silty and crumbly somewhat micaceous chocolate-brown; C-5
6	30.5	5.5	Sand, fine-grained to silty glauconitic and slightly micaceous greenish-tan to rust-brown; glauconite pale to dark-green giving a speckled "pepper and salt" effect; S-6

Remarks: *Equivalent clay bed exposed in roadcut is blocky and has closely spaced white and yellow silt partings; cuts waxy when moist.

E. C. SAXON PROPERTY

TEST HOLE J135A

Location: T.7 N., R.8 E., Sec. 24, SE.1/4, SE.1/4, SE.1/4. Beside a gum tree near fence corner in a pasture, 10 yards south of road fork.

Drilled: Dec. 12, 1940

Elevation: 419 feet

Water level: 25.2 feet

No.	Depth	Thick.	Description of strata
			Alluvium
1	4.0	4.0	Sand and silt top soil of fine-grained gray and brown
			Yegua formation
2	12.1	8.1	Silt, micaceous yellowish-tan, streaks of gray; contains streaks of silty clay and hard indurated sand pebbles; S-2
3	22.8	10.7	Clay, silty micaceous tan and gray grading to chocolate-brown in lower part; interlaminated in places with white micaceous silt; particles of lignite disseminated in the dark lower portion; P-3
4	36.2	13.4	Clay and silt interbedded; latter predominates in lower part. Clay, dark-gray silty micaceous, bearing fine lignite disseminations; silt gray micaceous; S-4

Perry Simmons Property

Test hole J137

Location: T.6 N., R.9 E., Sec. 13, SE.1/4, SE.1/4, SW.1/4. Near an old wagon road on the north slope of a hill at a point 30 yards east of old highway and approximately 3/4 mile north of Lake, Miss.

Drilled: Dec. 16, 17, 1940

Elevation: 454 feet

Water level: 17.0 feet

No.	Depth	Thick.	Description of strata
			Undifferentiated Jackson and alluvium
1	0.5	0.5	Loam, sandy black
2	4.0	3.5	Clay, arenaceous reddish-brown and tan; S-2
3	10.0	6.0	Clay, arenaceous rust-brown, mottled gray; scattered quartz pebbles; streaks and concretions of iron carbonate; S-3
			Moodys Branch marl
4	13.0	3.0	Clay, tan and gray, glauconitic in part; chalky lime nodules and streaks of dark sideritic material; abundant foraminifera in less weathered portions; S-4
5	19.2	6.2	Greensand marl, fine-grained argillaceous tan; glauconite partially altered pale green; lime particles and shell bits throughout; foraminifera abundant; S-5
			Yegua formation
6	24.0	4.8	Clay, silty tan laminated by white silt and streaked by greenish-brown sand; S-6
7	30.0	6.0	Clay, silty lignitic gray to black; granular pyrite concentrations; thin micaceous gray silt laminae at intervals; P-7
8	33.5	3.5	Sand mixed with clay, fine-grained slightly micaceous black; lignite and granular pyrite throughout; a 3-inch glauconitic sandy clay in uppermost part; S-8
9	34.5	1.0	Silt, micaceous lignitic thinly laminated light-gray and dark-gray; granular pyrite associated with lignitic material; S-9

ROBE GUNN PROPERTY

TEST HOLE J151

Location: T.8 N., R.7 E., Sec. 1, SW.1/4, NW.1/4, NE.1/4. Near fenced field at edge of woods at a point 25 yards north of a pond and 50 yards east of roadcut on hillside. Drilled: Jan. 6, 7, 1941

Elevation: 390 feet Water level: 8.0 feet

No.	Depth	Thick.	Description of strata
			Alluvium
1	2.0	2.0	Sand, fine gray
2	10.1	8.1	Sand, fine-grained argillaceous tan mottled gray and pink; S-2
			Yegua formation
3	11.2	1.1	Clay, slightly micaceous silty to arenaceous ocherous-yellow mottled gray; S-3
4	37.5	26.3	Clay, silty micaceous dark-brown (changing to black on exposure to atmosphere); scattered lignitic material and granules of pyrite; layers of fine-grained gray sand at 15.5 to 16.6 feet, thin layers at other intervals; P-4
5	51.2	13.7	Sand, fine-grained to silty and argillaceous, micaceous and lignitic; dark-gray streaks of tan and light-gray; silty clay laminations; S-5

Remarks: Hole caved.

ACKNOWLEDGMENTS

The geological and clay survey of Scott County was made possible through the support of the WPA, the Morton Lions Club, and the County Board of Supervisors. The survey was conducted in the usual manner for county units, labor for drilling and sampling being supplied by the WPA. Extreme difficulty was encountered in the lack of fully adequate equipment and, due to incompetence and insincerity of some of the labor, the most efficient standards could not be attained. Any critic of the project must keep these factors in mind. To the support and encouragement of the work, several individuals in Forest and Morton gave of their time. Special acknowledgments are due Mr. William G. Walter of Morton who gave freely of his services in securing the survey and overcame many of the difficulties that arose during the course of the investigations. The fine public spirit shown by Mr. Walter was a great encouragement. The Morton Motor Company is due thanks for providing transportation for the project on a cost basis, and the town of Morton for office space and storage facilities. Gratitude is also conveyed to the many others who aided and encouraged the survey. To Mr. Hugh Pendarvis, who assisted in the field during the summer of 1940 and to Miss Thelma Williams, who capably served as secretary and performed a considerable amount of the preparatory examinations in the microscopic studies of the small fossils, the writer desires to express his personal gratitude. Dr. William C. Morse kindly criticized and corrected the manuscript.

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SCOTT COUNTY TESTS

THOMAS EDWIN McCUTCHEON, B.S., CER. ENGR.

INTRODUCTORY SUMMARY

The clays of Scott County are of three general types. They have been classified as brick and tile clays, calcareous or limy clays, and clays of doubtful economic value.

The first type, brick and tile clays, has been further classified into four groups, each represented by a number of samples which have comparable sets of properties and which are generally suitable for the same quality of product.

The second type is from the Yazoo formation and is known as the Yazoo clay. The clays from the Yazoo are very uniform in character and composition. They are of little ceramic value because of their high lime content, but they could be utilized in the mineral wool and Portland cement industries.

The third type of clay is generally of marine origin and is characterized by high drying and burning shrinkage. The clays do possess high bond strength but are too impure for most uses and are consequently considered as being of doubtful economic value.

The four varieties of brick and tile clays are the materials most likely to be developed and are considered to have the greatest economic value. Group 1 is composed of three clays from different test holes. Their properties in the burned and unburned states and their drying and firing characteristics are well balanced. They can be made economically into many ceramic products of good quality and distinctive color. The clays of group 2 are unique inasmuch as they are of the lightweight variety and could be used to produce insulating building brick and blocks. Group 3 clays are somewhat similar to those of group 2 except that they have a higher drying shrinkage and burn to a harder body having less insulating value. The clays in group 4 are of poorer quality, especially as to color. Their drying and burning characteristics are satisfactory for common heavy clay products.

BRICK AND TILE CLAYS—GROUP 1

PHYSICAL PROPERTIES IN THE UNBURNED STATE

Hole No.	Sample No.	Water of plasticity in percent	Drying shrinkage		Modulus of rupture in pounds per square inch	Color
			Volume in percent	Linear in percent		
J117	3	34.08	44.58	17.87	700	Reddish gray
J135A	3	33.54	42.39	16.80	619	Yellowish gray
J151	4	29.53	27.75	10.29	466	Gray

SCREEN ANALYSES

Sample J117—3

Retained on screen	Percent	Character of residue
60	1.28	Abundance of nodules of cemented opaque silt grains, some stained with hematite; small amount of quartz; trace of earthy hematite.
100	2.58	Abundance of nodules of cemented opaque silt grains, some stained with limonite and hematite; small amounts of quartz and earthy hematite.
250	6.68	Abundance of nodules of cemented opaque silt grains, some stained with limonite and hematite; small amount of quartz.
Cloth	89.46	Clay substance including residue from above.

Sample J135A—3

Retained on screen	Percent	Character of residue
60	4.09	Abundance of nodules of opaque cemented silt grains; small amounts of limonitic nodules and ferruginous material.
100	3.58	Abundance of nodules of opaque cemented silt grains; small amounts of quartz, limonitic nodules, and ferruginous material.
250	7.78	Abundance of nodules of opaque cemented silt grains; considerable quantity of quartz; small amounts of limonitic nodules and ferruginous material.
Cloth	84.55	Clay substance including residue from above.

Sample J151—4

Retained on screen	Percent	Character of residue
60	11.30	Abundance of micaceous lignitic clay nodules.
100	11.03	Abundance of micaceous lignitic clay nodules.
250	17.33	Abundance of micaceous lignitic clay nodules; small amount of quartz; trace of muscovite.
Cloth	60.34	Clay substance including residue from above.

Alta Ray Gault, technician.

CHEMICAL ANALYSES*

Sample J117—3

Ignition loss 6.76
Silica, SiO_2 ......72.27
Alumina, Al_2O_3 ..15.38
Iron oxide, Fe_2O_3. 2.83
Titania, TiO_2 .... 1.19
Lime, CaO 0.17
Magnesia, MgO .. 0.98
Manganese, MnO_2. 0.29
Alkalies, (K_2O, Na_2O) 0.30

Sample J135A—3

Ignition loss 5.12
Silica, SiO_2 ......65.94
Alumina, Al_2O_3 ..20.81
Iron oxide, Fe_2O_3 . 2.66
Titania, TiO_2 .... 1.32
Lime, CaO 0.60
Magnesia, MgO .. 0.83
Manganese, MnO_2 Trace
Alkalies, (K_2O, Na_2O) 0.20

Sample J151—4

Ignition loss 8.04
Silica, SiO_2 ......68.40
Alumina, Al_2O_3 ..18.21
Iron oxide, Fe_2O_3. 1.46
Titania, TiO_2 .... 1.28
Lime, CaO 0.56
Magnesia, MgO .. 0.33
Manganese, MnO_2 None
Alkalies, (K_2O, Na_2O) 0.20

*Samples ground to pass 100 mesh screen.

B. F. Mandlebaum, analyst.

PYRO-PHYSICAL PROPERTIES

Test holes J117, J135A, J151

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks
J117 3	02	19.18	9.93	1.93	2.39	6.91	2.39	1031	Lt. buff
	1	15.27	7.69	1.99	2.34	9.77	3.38	3101	Lt. buff St. H.
	3	14.81	7.34	2.02	2.37	11.19	3.88	3850	Lt. buff
	5	14.20	7.03	2.03	2.36	11.37	3.95	3504	Lt. buff
	7	12.53	6.07	2.06	2.36	12.93	4.54	4490	Gray buff
	9	11.89	5.68	2.09	2.37	13.87	4.87	4639	Gray buff
	11	9.26	4.39	2.10	2.32	14.60	5.12	5343	Gray buff
	13	7.98	3.82	2.09	2.27	10.93	3.81	5516	Gray buff
J135A 3	02	22.41	11.85	1.89	2.43	3.92	1.35	1620	Salmon
	1	22.68	12.29	1.89	2.45	4.07	1.39	1916	Salmon
	3	21.79	11.37	1.92	2.45	5.50	1.87	2006	Salmon buff St. H.
	5	22.47	11.73	1.92	2.47	5.16	1.76	1931	Salmon buff
	7	19.42	9.98	1.95	2.42	8.61	2.99	N.D.	Gray buff
	9	18.56	9.45	1.98	2.43	8.15	2.81	2396	Gray buff
	11	14.64	7.35	1.99	2.34	8.96	3.09	3219	Gray buff
	13	14.64	7.35	1.98	2.42	8.15	2.81	2652	Gray buff
J151 4	02	26.79	15.10	1.78	2.42	6.44	2.22	1210	Cream
	1	27.03	15.21	1.78	2.44	6.16	2.11	1685	Cream
	3	26.59	14.79	1.80	2.45	7.47	2.57	2037	Cream
	5	25.02	13.58	1.84	2.46	9.48	3.27	2049	Cream St. H.
	7	22.52	11.73	1.92	2.49	13.35	4.68	2197	Buff, stained
	9	17.07	8.92	1.93	2.33	13.97	4.90	3285	Buff, stained
	11	17.07	8.72	1.96	2.36	14.86	5.24	3517	Buff, stained
	13	17.92	9.21	1.94	2.36	13.89	4.87	3370	Buff, stained

Abbreviation: St. H., steel hard.

POSSIBILITIES FOR UTILIZATION

The three clays classified as group 1 brick and tile clays have excellent plastic, drying, and burning properties. Although individual samples have distinctive characteristics, they are suited for the same class of products.

Sample J117-3 burns to warm shades of light buff and gray buff. The firing range extends from cone 02 through cone 13. Porosity and absorption values decrease slightly with advancing heat treatment. Linear shrinkage is low, and the modulus of rupture is considerably above the average from cone 1 through cone 13. The clay is suitable for making high grade light colored face brick, enamel brick, terra cotta, faiance, stone ware, silo tile, conduit, and yellow ware. Building block and facing tile in natural, enameled, and salt glaze finishes are possibilities.

Sample J135A-3 is similar to sample J117-3 except that it is more open bodied and burns to darker colors. It is particularly suited for making a high grade multi-colored face brick. The more common heavy clay products such as hollow partition tile, load bearing tile, drain tile and building block could easily be made from this clay.

Sample J151-4 is distinctive because of its burned colors of cream and buff. The clay contains soluble calcium salts which cause a scum on the surface of the burned material. The scum is indistinguishable through cone 5 but becomes evident at higher cones and forms a slightly glazed surface at cones 11 and 13. This problem could be corrected by the addition of soluble barium salt or by limiting the utilization of the clay to dry-press products. In this respect the clay would make a very distinctive high grade light colored face brick.

BRICK AND TILE CLAYS—GROUP 2

PHYSICAL PROPERTIES IN THE UNBURNED STATE

Hole No.	Sample No.	Water of plasticity in percent	Drying shrinkage		Modulus of rupture in pounds per square inch	Color
			Volume in percent	Linear in percent		
J5A	3	59.02	25.97	9.55	311	Dk. cream
J6	3	49.47	31.19	11.72	379	Gray
J8	3	31.89	38.78	15.10	517	Tan
J8C	3	58.57	50.70	21.00	483	Gray
J8	6	48.72	42.23	16.75	514	Lt. gray

SCREEN ANALYSES

Sample J8—3

Retained on screen	Percent	Character of residue
60	1.34	Abundance of nodules of cemented opaque silt grains, some stained with limonite; small amounts of plant fragments and quartz.
100	2.36	Abundance of nodules of cemented opaque silt grains, some stained with limonite; small amount of quartz.
250	8.82	Abundance of quartz; considerable quantities of cemented opaque silt grains and ferruginous material; small amount of muscovite.
Cloth	87.48	Clay substance including residue from above.

Sample J8—6

Retained on screen	Percent	Character of residue
60	16.87	Abundance of white arenaceous clay nodules; small amount of quartz.
100	4.64	Abundance of white arenaceous clay nodules; small amount of quartz; trace of limonite.
250	9.55	Abundance of white clay nodules; small amount of quartz.
Cloth	68.94	Clay substance including residue from above.

Alta Ray Gault, technician.

CHEMICAL ANALYSES*

Sample J8—3

Ignition loss 6.73	Iron oxide, Fe_2O_3. 2.38	Magnesia, MgO .. 1.43
Silica, SiO_2 ......69.33	Titania, TiO_2 .... 0.65	Manganese, MnO_2 None
Alumina, Al_2O_3 ..18.01	Lime, CaO 0.29	Alkalies, (K_2O, Na_2O) 0.14

Sample J8—6

Ignition loss 6.09	Iron oxide, Fe_2O_3. 2.22	Magnesia, MgO .. 0.30
Silica, SiO_2 ......72.32	Titania, TiO_2 .... 0.66	Manganese, MnO_2. 0.42
Alumina, Al_2O_3 ..15.89	Lime, CaO 0.43	Alkalies, (K_2O, Na_2O) 0.22

*Samples ground to pass 100 mesh screen.

B. F. Mandlebaum, analyst.

PYRO-PHYSICAL PROPERTIES

TEST HOLES J5A, J6, J8, J8C

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks	
J5A 3	02	48.65	37.55	1.29	2.53	10.95	3.81	966	Pink	
	1	48.24	36.49	1.32	2.55	12.61	4.43	943	Pink	St. H.
	3	48.39	37.00	1.31	2.54	11.74	4.10	974	Pink	
	5	46.92	34.73	1.35	2.55	14.68	5.16	1330	Pink	
	7	44.92	32.31	1.39	2.53	17.11	6.10	1365	Buff	
	9	43.80	30.93	1.42	2.52	18.59	6.63	1454	Buff	
	11	43.14	30.63	1.45	2.51	20.31	7.32	1629	Buff	
	13	40.32	26.99	1.49	2.50	22.95	8.34	1914	Buff	
J6 3	02	41.39	27.85	1.48	2.54	9.81	.64	1256	Cream	
	1	40.62	27.13	1.50	2.52	10.61	3.70	1331	Cream	St. H.
	3	39.77	26.02	1.53	2.54	12.73	4.46	1620	Cream	
	5	38.74	24.89	1.56	2.54	13.93	4.90	1803	Pink	
	7	36.91	23.07	1.62	2.57	17.41	6.21	1902	Buff	
	9	33.55	20.05	1.68	2.52	20.11	7.25	2009	Buff	
	11	28.87	16.32	1.77	2.48	24.30	8.86	2403	Buff	
	13	23.44	12.55	1.87	2.44	28.17	10.45	2539	Buff	
J8 3	02	26.35	14.15	1.86	2.53	3.65	1.25	1555	Salmon buff	
	1	25.75	13.67	1.89	2.54	4.27	1.46	1860	Salmon buff	St. H.
	3	26.23	13.89	1.89	2.56	4.81	1.66	2051	Salmon buff	
	5	25.98	13.64	1.90	2.58	5.93	2.04	2130	Salmon buff	
	7	23.43	12.22	1.92	2.50	6.43	2.22	2002	Buff	
	9	23.51	12.30	1.92	2.51	6.89	2.36	2677	Buff	
	11	22.09	11.45	1.93	2.50	6.91	2.39	2920	Buff	
	13	23.20	12.06	1.93	2.51	6.92	2.39	3090	Buff	
J8C 3	02	35.61	22.84	1.56	2.42	10.62	3.70	1311	Cream	
	1	34.79	21.92	1.59	2.44	12.27	4.28	2097	Cream	
	3	33.65	21.09	1.59	2.40	13.11	4.61	2399	Cream	
	5	33.59	20.69	1.62	2.44	14.36	5.05	3056	Cream	St. H.
	7	29.53	17.65	1.67	2.38	16.99	6.02	3318	Buff	
	9	23.79	13.44	1.77	2.33	21.37	7.71	3264	Buff	
	11	17.84	9.51	1.88	2.28	25.87	9.51	3619	Buff	
	13	17.19	8.94	1.92	2.32	27.40	10.12	3844	Buff	
J8 6	02	32.66	20.49	1.59	2.37	8.07	2.78	1154	Cream	
	1	38.49	23.61	1.63	2.74	10.37	3.59	1643	Cream	St. H.
	3	31.95	19.93	1.60	2.35	8.88	3.06	1636	Cream	
	5	29.43	17.52	1.68	2.38	12.88	4.50	2440	Cream	
	7	25.69	14.78	1.74	2.34	15.85	5.61	2535	Buff	
	9	21.33	11.91	1.80	2.28	18.62	6.67	3249	Buff	
	13	17.62	9.23	1.91	2.32	23.36	8.50	3325	Buff	

Abbreviation: St. H., steel hard.

POSSIBILITIES FOR UTILIZATION

The brick and tile clays of group 2 are of the light-weight variety. Sample J5A-3 has the lowest bulk specific gravity when burned at various temperatures, and sample J8-3 has the highest bulk specific gravity. The plastic properties of the several clays are excellent for machine extruded ware. The clays dry without cracking or warping. The linear drying shrinkage of some of the samples is rather high but would be considerably less in commercial practice. Dry strength is adequate for thin wall hollow tile. The alterations on burning such as changes in porosity, absorption, specific gravity, shrinkage, and strength, are rather gradual over a long firing range. Color changes are also gradual with increasing heat treatment. The outstanding characteristic of the clays is their levity which is attributed to microscopic pores.

The clays are suitable for light colored face brick, building block, and partition tile. When used for these materials they would lend considerable insulating value to the structure. Transportation costs per unit would be less than the usual run of heavy clay products. The physical requirements of drain tile and flue lining would easily be met when made from these clays.

BRICK AND TILE CLAYS—GROUP 3

PHYSICAL PROPERTIES IN THE UNBURNED STATE

Hole No.	Sample No.	Water of plasticity in percent	Drying shrinkage		Modulus of rupture in pounds per square inch	Color
			Volume in percent	Linear in percent		
J8	8	38.06	47.15	19.18	775	Gray
J8B	3	31.83	44.43	17.82	632	Yellowish gray
J19	2-3	44.53	52.77	22.13	585	Brownish gray
J21	2	39.40	52.35	21.92	451	Brownish gray
J22	4	41.68	49.92	20.63	739	Gray
J22	5	43.48	45.87	18.52	631	Gray
J24	2	41.08	52.68	22.09	480	Brownish gray
J25	3	42.68	55.43	23.65	570	Brownish gray
J25	4	40.17	45.87	18.52	459	Brownish gray
J97	P2	53.68	50.67	21.00	390	Brownish gray
J118	3	51.72	51.17	21.27	564	Lt. brown

SCREEN ANALYSES

Sample J8—8

Retained on screen	Percent	Character of residue
60	5.81	Abundance of nodules of gray arenaceous clay nodules; trace of quartz.
100	3.95	Abundance of nodules of gray arenaceous clay nodules; small amount of quartz.
250	16.00	Abundance of quartz; small amount of clay nodules.
Cloth	74.24	Clay substance including residue from above.

Sample J21—2

Retained on screen	Percent	Character of residue
60	4.16	Abundance of arenaceous gray clay nodules, considerable quantity stained with limonite; small amount of limonitic nodules.
100	8.13	Abundance of waxy gray clay nodules, considerable quantity stained with limonite; small amount of quartz.
250	13.13	Abundance of waxy gray clay nodules, considerable quantity stained with limonite; small amount of quartz.
Cloth	74.58	Clay substance including residue from above.

Sample J22—4

Retained on screen	Percent	Character of residue
60	8.34	Abundance of arenaceous clay nodules; trace of limonitic nodules.
100	6.02	Abundance of arenaceous clay nodules; trace of muscovite.
250	19.88	Abundance of arenaceous clay nodules; considerable quantities of quartz and muscovite.
Cloth	65.76	Clay substance including residue from above.

Sample J22—5

Retained on screen	Percent	Character of residue
60	39.12	Abundance of gray arenaceous clay nodules; trace of lignite.
100	9.43	Abundance of gray arenaceous clay nodules; small amount of lignite.
250	16.88	Abundance of gray arenaceous clay nodules; small amount of lignite.
Cloth	34.57	Clay substance including residue from above.

Alta Ray Gault, technician.

CHEMICAL ANALYSES*

Sample J8—8

Ignition loss	5.67	Iron oxide, Fe_2O_3	2.30	Magnesia, MgO	0.53
Silica, SiO_2	72.74	Titania, TiO_2	0.61	Manganese, MnO_2	0.15
Alumina, Al_2O_3	15.43	Lime, CaO	0.66	Alkalies, (K_2O, Na_2O)	0.47

Sample J21—2

Ignition loss	5.55	Iron oxide, Fe_2O_3	4.96	Magnesia, MgO	0.43
Silica, SiO_2	71.30	Titania, TiO_2	0.76	Manganese, MnO_2	None
Alumina, Al_2O_3	15.39	Lime, CaO	0.45	Alkalies, (K_2O, Na_2O)	0.31

Sample J22—4

Ignition loss	5.40	Iron oxide, Fe_2O_3	2.85	Magnesia, MgO	0.31
Silica, SiO_2	73.10	Titania, TiO_2	0.79	Manganese, MnO_2	Trace
Alumina, Al_2O_3	15.52	Lime, CaO	0.32	Alkalies, (K_2O, Na_2O)	0.32

Sample J22—5

Ignition loss	6.46	Iron oxide, Fe_2O_3	3.34	Magnesia, MgO	1.03
Silica, SiO_2	71.77	Titania, TiO_2	0.48	Manganese, MnO_2	0.36
Alumina, Al_2O_3	15.48	Lime, CaO	0.54	Alkalies, (K_2O, Na_2O)	0.62

*Samples ground to pass 100 mesh screen.

B. F. Mandlebaum, analyst.

PYRO-PHYSICAL PROPERTIES

TEST HOLES J8, J8B, J19, J21, J22

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks	
J8 8	02	24.31	13.21	1.84	2.48	6.05	2.08	1717	Lt. buff	St. H.
	1	25.27	13.62	1.86	2.48	6.75	2.32	1826	Lt. buff	
	3	25.31	13.62	1.86	2.37	7.07	2.42	2532	Buff	
	5	21.89	11.51	1.90	2.44	9.08	3.13	2422	Salmon buff	
	7	19.13	9.87	1.94	2.40	11.00	3.81	3436	Buff	
	9	18.41	9.33	1.97	2.42	12.83	4.50	2910	Buff	
	11	16.85	8.43	2.00	2.41	14.55	5.12	3378	Dk. buff	
	13	17.59	8.83	1.99	2.42	13.34	4.68	3652	Dk. buff	
J8B 3	02	19.45	9.87	1.97	2.44	5.47	1.87	2102	Lt. buff	St. H.
	1	19.09	9.63	1.98	2.45	6.25	2.15	2359	Salmon buff	
	3	18.99	9.62	1.97	2.44	6.32	2.18	2384	Salmon buff	
	5	17.89	8.92	1.99	2.42	6.71	2.32	3134	Salmon buff	
	7	16.75	8.39	2.00	2.40	6.92	2.39	3686	Buff	
	9	16.46	8.15	2.01	2.41	7.50	2.57	2633	Buff	
	11	17.53	8.63	2.03	2.46	8.43	2.92	2906	Buff	
	13	17.81	8.82	2.02	2.45	7.76	2.67	3668	Dk. buff	
J19 2-3	02	21.84	10.99	2.01	2.55	16.11	5.72	795	Buff	St. H.
	1	15.99	7.51	2.13	2.54	21.40	7.71	Cr.	Buff	
	3	13.45	6.21	2.16	2.50	22.85	8.30	Cr.	Buff	
	5	13.09	6.05	2.17	2.49	22.92	8.34	1600	Buff	
	7	12.49	6.11	2.04	2.33	18.53	6.63	3151	Grayish brown	
	9	10.50	4.84	2.16	2.42	23.14	8.42	2996	Grayish brown	
	11	9.27	4.37	2.12	2.34	21.48	7.75	3273	Grayish brown	
J21 2	02	25.13	13.19	1.91	2.55	5.98	2.04	Cr.	Salmon	St. H.
	1	26.85	13.21	2.04	2.78	6.25	2.15	Cr.	Salmon	
	3	23.07	11.96	1.93	2.50	6.81	2.39	Cr.	Lt. red	
	5	22.99	11.91	1.93	2.51	7.35	2.53	Cr.	Lt. red	
	7	21.55	11.22	1.92	2.45	7.12	2.46	3151	Grayish brown	
	9	16.13	8.23	1.96	2.33	8.99	3.09	2996	Grayish brown	
	11	15.82	8.08	1.96	2.33	8.61	2.99	3273	Grayish brown	
J22 4	02	26.75	15.04	1.78	2.43	6.81	2.36	1744	Lt. buff	
	1	25.23	13.91	1.82	2.43	8.33	2.88	1773	Buff	St. H.
	3	24.25	13.19	1.84	2.43	9.45	3.27	2089	Buff	
	5	23.11	12.47	1.85	2.41	10.43	3.63	2834	Buff	
	7	19.03	9.93	1.92	2.37	13.71	4.83	2995	Gray buff	
	9	18.60	9.25	1.95	2.37	15.07	5.31	2813	Gray buff	
	11	14.35	7.09	2.02	2.37	18.16	6.48	3108	Gray buff	
J22 5	02	30.11	17.29	1.74	2.49	8.31	2.88	1396	Salmon	
	1	30.26	17.29	1.75	2.51	9.49	3.27	1884	Salmon	
	3	28.71	16.08	1.78	2.51	11.28	3.92	1405*	Salmon	
	5	27.47	15.16	1.81	2.51	12.66	4.43	1391*	Lt. red	St. H.
	7	23.33	12.43	1.88	2.45	15.30	5.38	2860	Dk. buff	
	9	17.97	9.16	1.96	2.40	19.23	6.90	2829	Dk. buff	
	11	14.14	6.80	2.03	2.35	21.89	7.91	2197	Dk. buff	

Abbreviation: St. H., steel hard; Cr., cracked.
*Cracked on firing.

TEST HOLES J24, J25, J97, J118

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks	
J24 2	02	19.74	9.52	2.07	2.58	14.74	4.20	1368	Buff	St. H.
	1	20.49	10.07	2.04	2.56	13.33	4.68	1193*	Buff	
	3	18.73	9.05	2.07	2.55	15.11	5.35	Cr.	Buff	
	5	17.70	8.44	2.10	2.55	16.37	5.80	Cr.	Buff	
	7	15.55	7.77	2.00	2.37	12.24	4.28	2460	Grayish brown	
	9	12.72	5.91	2.15	2.46	18.23	6.52	3419	Grayish brown	
	11	11.37	5.38	2.11	2.38	16.84	5.98	3362	Grayish brown	
J25 3	02	20.17	9.92	2.04	2.55	15.43	5.46	1021	Salmon	St. H.
	1	20.60	10.02	2.06	2.59	16.22	5.76	1980	Salmon	
	3	17.05	8.08	2.11	2.54	18.77	6.71	2282	Lt. red	
	5	15.03	7.06	2.13	2.50	19.05	6.82	3015	Lt. red	
	7	14.33	6.97	2.06	2.40	16.19	5.72	3577	Grayish brown	
	9	12.61	5.82	2.16	2.48	20.77	7.48	4051	Grayish brown	
	11	11.20	5.20	2.16	2.48	19.73	7.09	2892	Grayish brown	
J25 4	02	18.52	9.05	2.05	2.52	16.97	6.02	1060*	Lt. buff	St. H.
	1	15.07	7.96	2.14	2.53	21.13	7.63	2340	Buff	
	3	12.41	5.54	2.19	2.50	22.65	8.22	3746	Buff	
	5	11.96	5.47	2.19	2.48	21.96	7.95	Cr.	Dk. buff	
	7	10.97	5.25	2.08	2.35	18.93	6.78	4255	Grayish brown	
	9	9.04	4.08	2.21	2.44	23.27	8.46	3239	Grayish brown	
	11	8.66	3.99	2.17	2.38	21.92	7.95	2679	Grayish brown	
J97 P2	02	30.24	17.23	1.76	2.52	16.87	5.98	Cr.	Buff	St. H.
	1	29.65	16.68	1.78	2.53	17.86	6.36	Cr.	Buff	
	3	29.49	16.52	1.79	2.53	18.84	6.74	1518	Buff	
	5	27.53	15.15	1.82	2.51	19.32	6.94	Cr.	Buff	
	7	15.46	8.12	1.91	2.25	23.60	8.58	2120	Grayish brown	
	9	15.30	8.20	1.93	2.27	25.05	9.18	2094	Grayish brown	
	11	10.44	5.04	2.07	2.31	29.36	10.96	2758	Grayish brown	
J118 3	02	26.97	14.71	1.83	2.51	18.70	6.67	Cr.	Salmon buff	St. H.
	1	27.10	14.75	1.84	2.52	18.51	6.63	Cr.	Salmon buff	
	3	25.77	13.92	1.85	2.50	19.23	6.90	1881	Salmon buff	
	5	24.93	13.43	1.86	2.47	19.49	6.98	Cr.	Salmon buff	
	7	17.05	9.44	1.81	2.18	17.72	6.32	2365	Grayish brown	
	9	23.03	15.31	1.51	1.96	4.78	1.63	N.D.	Grayish brown	

Abbreviation: St. H., steel hard; Cr., cracked.
*Cracked on firing.

POSSIBILITIES FOR UTILIZATION

The brick and tile clays of group 3 are similar to those in group 2 with the exception that they burn to darker colors and denser bodies. Drying and burning shrinkage is slightly greater. They are of about the same density as the usual variety of brick and tile clays. The burned colors of salmon, buff, and brown are desirable in face brick and building block, and in this respect the clays are especially suitable. Hollow tile, drain tile, and common brick are products which can easily be made from these clays.

BRICK AND TILE CLAYS—GROUP 4

PHYSICAL PROPERTIES IN THE UNBURNED STATE

Hole No.	Sample No.	Water of plasticity in percent	Drying shrinkage		Modulus of rupture in pounds per square inch	Color
			Volume in percent	Linear in percent		
J24	6	31.45	25.57	9.39	306	Dk. gray
J41	3	28.64	20.23	7.28	305	Dk. gray
J85A	1	37.51	52.00	22.25	622	Yellowish gray
J86	2-3	34.13	45.80	18.47	580	Yellowish gray
J100	P3	32.02	31.51	11.89	307	Dk. gray

SCREEN ANALYSES

SAMPLE J41—3

Retained on screen	Percent	Character of residue
60	27.47	Abundance of lignitic silt nodules; small amount of quartz; trace of pyrite.
100	7.48	Abundance of lignitic micaceous silt nodules; small amount of quartz; trace of lignite.
250	11.66	Abundance of lignitic micaceous silt nodules; small amount of quartz.
Cloth	53.39	Clay substance including residue from above.

SAMPLE J86—2-3

Retained on screen	Percent	Character of residue
60	3.27	Abundance of limonitic stained silt nodules, some not stained; considerable quantity of ferruginous nodules; trace of quartz.
100	7.64	Abundance of limonitic stained silt nodules; small amount of ferruginous material.
250	4.79	Abundance of limonitic stained silt nodules, some not stained; considerable quantity of ferruginous material; small amount of quartz.
Cloth	84.30	Clay substance including residue from above.

Alta Ray Gault, technician.

CHEMICAL ANALYSES*

Sample J41—3

Ignition loss 6.50	Iron oxide, Fe_2O_3. 2.93	Magnesia, MgO .. 0.55
Silica, SiO_2 ......72.25	Titania, TiO_2 .... 0.85	Manganese, MnO_2. 0.24
Alumina, Al_2O_3 ..14.27	Lime, CaO 0.60	Alkalies, (K_2O, Na_2O) 0.42

Sample J86—2-3

Ignition loss 4.54	Iron oxide, Fe_2O_3. 4.73	Magnesia, MgO .. 0.64
Silica, SiO_2 ......73.15	Titania, TiO_2 .... 1.06	Manganese, MnO_2 Trace
Alumina, Al_2O_3 ..13.28	Lime, CaO 1.37	Alkalies, (K_2O, Na_2O) 0.43

*Samples ground to pass 100 mesh screen.
B. F. Mandlebaum, analyst.

PYRO-PHYSICAL PROPERTIES

Test holes J24, J41, J85A, J86, J100

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks	
J24 6	02	25.63	13.27	1.93	2.60	16.67	5.91	945	Lt. red	St. H.
	1	24.84	12.71	1.95	2.60	17.31	6.17	1087	Lt. red	
	3	23.34	11.93	1.96	2.56	17.78	6.32	1304	Lt. red	
	5	22.39	11.49	1.97	2.53	17.67	6.29	1420	Lt. red	
	7	20.37	11.44	1.78	2.24	9.36	3.24	2474	Reddish brown	
J41 3	02	33.18	19.00	1.75	2.61	4.74	1.63	570	Buff	
	1	34.63	19.91	1.74	2.66	5.12	1.76	804	Buff	
	3	31.41	17.77	1.77	2.58	6.24	2.15	N.D.	Buff	
	5	33.44	20.92	1.77	2.62	6.33	2.18	N.D.	Buff	
	7	30.15	16.53	1.82	2.64	9.33	3.24	N.D.	Gray buff	St. H.
	9	25.93	14.45	1.80	2.43	8.12	2.81	N.D.	Gray buff	
	11	23.62	12.49	1.89	2.48	12.31	4.32	N.D.	Gray buff	
J85A 1	02	24.77	12.59	1.97	2.61	5.94	2.04	Cr.	Dull red	St. H.
	1	24.26	12.25	1.98	2.62	6.12	2.11	Cr.	Dull red	
	3	23.26	11.75	1.98	2.59	6.31	2.18	Cr.	Dull red	
	5	24.09	12.17	1.98	2.61	6.59	2.25	Cr.	Dull red	
	7	21.05	11.09	1.90	2.40	2.65	.91	Cr.	Brown	
J86 2-3	02	26.28	14.03	1.88	2.53	.51	.20	1865	Salmon	
	1	25.69	13.73	1.87	2.52	1.26	.44	2040	Lt. red	St. H.
	3	24.53	13.05	1.88	2.50	.99	.33	2341	Lt. red	
	5	25.67	13.68	1.88	2.52	9.88	3.42	3090	Lt. red	
	7	23.92	12.77	1.88	2.46	10.05	3.49	Cr.	Reddish brown	
	9	23.21	12.23	1.90	2.47	2.01	.70	2568	Reddish brown	
	11	20.87	11.13	1.88	2.37	.83	.30	N.D.	Reddish brown	
	13	19.37	10.55	1.84	2.28	—1.00	—.33	N.D.	Reddish brown	
J100 P3	02	33.66	19.23	1.75	2.64	5.17	1.76	675	Reddish buff	
	1	33.25	18.90	1.76	2.64	5.69	1.94	657	Reddish buff	St. H.
	3	31.73	17.82	1.78	2.60	7.01	2.42	817	Reddish buff	
	5	31.03	17.47	1.78	2.58	6.99	2.39	792	Reddish buff	
	7	29.80	17.17	1.74	2.47	4.91	1.70	1042	Brown	
	9	24.31	14.75	1.65	2.17	—1.11	—.41	1150	Brown	Bl.

Abbreviation: St. H., steel hard; Bl., bloated; Cr., cracked.

POSSIBILITIES FOR UTILIZATION

The brick and tile clays of group 4 with the exception of sample J85A-1 are suitable for common brick, drain tile, and hollow partition tile. The clays are red burning; they have fair plastic properties and low burning shrinkage and mature at low temperatures. They contain sand and silt in appreciable quantities. The burned colors of samples J24-6, J86-2-3, and J100-P3 are even shades of red, reddish brown, and dark brown which are desirable for face brick, and in this respect the clays are well suited. Sample J41-3 is stained with calcium salts and is not suitable for face brick but would make common brick, drain tile, and hollow tile. Sample J85A-1 cracked on burning and is not considered suitable for ceramic products.

YAZOO CLAY

PHYSICAL PROPERTIES IN THE UNBURNED STATE

Hole No.	Sample No.	Water of plasticity in percent	Drying shrinkage		Modulus of rupture in pounds per square inch	Color
			Volume in percent	Linear in percent		
J27	2	51.10	76.18	38.03	863	Gray
J86	4	39.34	57.02	24.58	862	Yellowish gray
J86	5-7	45.00	55.23	23.54	683	Lt. gray
J89	1	42.27	45.23	18.22	562	Tan
J89	2-3	39.50	47.15	19.18	750	Lt. gray

SCREEN ANALYSES

SAMPLE J86—4

Retained on screen	Percent	Character of residue
60	3.34	Abundance of limonitic stained clay nodules; considerable quantities of fossils and calcareous clay nodules.
100	3.71	Abundance of fossils; considerable quantity of limonitic calcareous clay nodules.
250	6.79	Abundance of limonitic calcareous clay nodules; considerable quantity of fossils.
Cloth	86.16	Clay substance including residue from above.

SAMPLE J86—5-7

Retained on screen	Percent	Character of residue
60	7.07	Abundance of calcareous clay nodules; small amount of fossils.
100	10.70	Abundance of calcareous clay nodules; considerable quantity of fossils; trace of glauconite.
250	17.05	Abundance of calcareous clay nodules; considerable quantity of fossils; trace of glauconite.
Cloth	65.18	Clay substance including residue from above.

SAMPLE J89—1

Retained on screen	Percent	Character of residue
60	4.45	Abundance of calcareous clay nodules; small amounts of fossils and ferruginous material.
100	9.19	Abundance of calcareous limonitic stained clay nodules; small amounts of fossils and quartz.
250	14.44	Abundance of calcareous limonitic stained clay nodules; small amounts of fossils and ferruginous material.
Cloth	71.92	Clay substance including residue from above.

SAMPLE J89—2-3

Retained on screen	Percent	Character of residue
60	5.21	Abundance of calcareous clay nodules; considerable quantity of fossils; small amounts of quartz, calcite, and glauconite.
100	8.84	Abundance of calcareous clay nodules; considerable quantity of fossils; small amounts of glauconite and quartz.
250	10.21	Abundance of calcareous clay nodules; considerable quantity of fossils; small amount of glauconite.
Cloth	75.74	Clay substance including residue from above.

Alta Ray Gault, technician.

CHEMICAL ANALYSES*

SAMPLE J86—4

Ignition loss 23.35
Silica, SiO_2 ......30.45
Alumina, Al_2O_3 ..12.31
Iron oxide, Fe_2O_3. 5.16
Titania, TiO_2 .... 0.47
Lime, CaO 25.00
Magnesia, MgO .. 0.12
Manganese, MnO_2. 0.09
Alkalies, K_2O, Na_2O) 0.29
Sulfur, SO_3 ...... 1.88

SAMPLE J86—5-7

Ignition loss 25.03
Silica, SiO_2 ......27.30
Alumina, Al_2O_3 ..11.62
Iron oxide, Fe_2O_3. 3.37
Titania, TiO_2 .... 0.36
Lime, CaO 26.90
Magnesia, MgO .. 0.25
Manganese, MnO_2. 0.28
Alkalies, (K_2O, Na_2O) 0.17
Sulfur, SO_3 ...... 3.18

SAMPLE J89—1

Ignition loss 22.77
Silica, SiO_2 ......33.02
Alumina, Al_2O_3 ..14.21
Iron oxide, Fe_2O_3. 3.70
Titania, TiO_2 .... 0.48
Lime, CaO 24.03
Magnesia, MgO .. 0.15
Manganese, MnO_2. 0.21
Alkalies, (K_2O, Na_2O) 0.34
Sulfur, SO_3 ......None

SAMPLE J89—2-3

Ignition loss 26.80	Titania, TiO_2 .... 0.48	Manganese, MnO_2 None
Silica, SiO_2 ......25.60	Lime, CaO 29.97	Alkalies, (K_2O, Na_2O) 0.61
Alumina, Al_2O_3 ..11.41	Magnesia, MgO .. 0.23	Sulfur, SO_3 ...... 1.10
Iron oxide, Fe_2O_3. 3.26		

*Samples ground to pass 100 mesh screen.
B. F. Mandlebaum, analyst.

PYRO-PHYSICAL PROPERTIES

TEST HOLES J27, J86, J89

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks	
J27 2	02	15.38	13.05	1.81	2.14	15.07	5.31	Cr.	Greenish gray	St. H.
J86 4	02	26.09	16.31	1.60	2.17	7.33	2.53	2656*	Greenish gray	
	1	29.69	18.89	1.60	2.27	7.33	2.53	2904*	Greenish gray	St. H.
J86 5-7	02	27.13	16.68	1.62	2.23	16.67	4.91	2987	Greenish gray	
	1	29.21	18.55	1.63	2.31	17.31	6.17	3163	Greenish gray	
	3	29.00	16.51	1.76	2.48	23.57	8.58	3064	Greenish gray	
	5	38.09	23.49	1.63	2.62	17.75	6.32	2181	Greenish gray	
	7	9.23	4.58	2.02	2.23	34.17	13.02	2135	Greenish gray	St. H.
J89 1	02	24.16	13.70	1.76	2.32	22.25	8.07	Cr.	Greenish gray	
	1	24.06	13.67	1.76	2.32	22.06	7.99	Cr.	Greenish gray	
	3	24.97	14.15	1.77	2.35	16.31	5.80	Cr.	Greenish gray	
	5	29.85	17.47	1.72	2.44	19.99	7.17	Cr.	Greenish gray	
	7	1.50	.81	1.85	1.87	25.67	9.43	Cr.	Green	St. H.
J89 2-3	02	29.47	18.78	1.57	2.23	14.37	5.05	1464	Greenish gray	
	1	30.71	20.05	1.53	2.21	12.31	4.32	2121	Greenish gray	
	3	32.59	20.31	1.60	2.37	16.31	5.80	2349	Greenish gray	
	5	39.63	25.47	1.53	2.50	12.89	4.50	2378	Greenish gray	
	7	29.21	16.48	1.78	2.51	24.77	9.06	2558	Greenish gray	St. H.
	9	14.99	7.96	1.89	2.22	29.46	11.00	2416	Yellowish green	

Abbreviation: St. H., steel hard; Cr., cracked.
*Cracked on firing.

POSSIBILITIES FOR UTILIZATION

The drying shrinkage of the Yazoo clay is too high for use in ceramic products. The clay burns to pale greenish-yellow colors. Although ceramic products could be formed and burned from this type of clay, it is doubtful that they would be stable under weathering conditions due to the high lime content. The clays tested have high bond strength and are very plastic. They could be utilized by blending with sand and lime and forming the mixture into "brick" for subsequent use as "wool rock" for the production of mineral wool. Should Portland cement be produced in Mississippi the clay is suitable for blending with limestone, furnishing the necessary alumina, some lime, and silica.

CLAYS OF DOUBTFUL ECONOMIC VALUE

PHYSICAL PROPERTIES IN UNBURNED STATE

Hole No.	Sample No.	Water of plasticity in percent	Drying shrinkage		Modulus of rupture in pounds per square inch	Color
			Volume in percent	Linear in percent		
J21	3	38.97	44.92	18.07	371	Dk. gray
J85	2	48.38	76.48	38.29	461	Greenish gray
J85	3-4	52.18	76.08	37.94	375	Gray
J88	2	39.40	62.87	28.14	831	Gray
J88	4	37.87	50.00	20.63	597	Gray
J91	2	48.78	73.70	35.93	896	Yellowish gray
J91	3	50.07	64.42	29.19	857	Gray
J92	P2	53.03	75.55	37.51	N. D.	Brownish gray
J106	4	55.70	86.50	48.70	N. D.	Yellowish gray

SCREEN ANALYSIS

SAMPLE J21—3

Retained on screen	Percent	Character of residue
60	19.65	Abundance of lignitic clay nodules, some stained with limonite; traces of lignite and quartz.
100	21.00	Abundance of lignitic clay nodules stained with limonite; small amount of quartz.
250	18.55	Abundance of limonitic clay nodules, some lignitic clay nodules; small amount of quartz.
Cloth	40.80	Clay substance including residue from above.

Alta Ray Gault, technician.

CHEMICAL ANALYSIS*

SAMPLE J21—3

Ignition loss 7.83
Silica, SiO_2 ......66.08
Alumina, Al_2O_3 ..18.01
Iron oxide, Fe_2O_3. 5.41
Titania, TiO_2 .... 0.66
Lime, CaO 0.54
Magnesia, MgO .. 0.71
Manganese, MnO_2 None
Alkalies, (K_2O. Na_2O) 0.63

*Sample ground to pass 100 mesh screen.

B. F. Mandlebaum. analyst.

PYRO-PHYSICAL PROPERTIES

TEST HOLES J21, J85, J88, J91, J92, J106

Hole No. Sample No.	At cone	Porosity in percent	Absorption in percent	Bulk specific gravity	Apparent specific gravity	Volume shrinkage in percent	Linear shrinkage in percent	Modulus of rupture in lbs./sq. in.	Color and remarks
J21 3	02	21.61	10.79	2.01	2.56	16.02	5.68	Cr.	Salmon buff St. H.
	1	21.53	10.08	2.14	2.72	21.13	7.63	Cr.	Salmon buff
J85 2	02	20.29	13.60	1.49	1.88	—9.50	—3.27	Cr.	Dull red Bl. St. H.
J85 3-4	02	11.54	6.45	1.79	2.02	13.79	4.83	Cr.	Salmon gray Cr. St. H.
J88 2	02	14.31	6.90	2.07	2.42	11.70	4.06	Cr.	Dull red St. H.
	1	14.50	6.95	2.08	2.44	12.53	4.39	2387	Dull red
	3	13.29	6.37	2.09	2.41	12.35	4.32	2787	Dull red
	5	15.19	7.30	2.08	2.46	12.48	4.35	Cr.	Dull red
	7	18.53	9.77	1.89	2.32	5.58	1.90	2337	Brown
J88 4	02	20.59	10.69	1.93	2.43	6.52	2.25	1622	Buff St. H.
	1	20.41	10.51	1.94	2.44	7.61	2.64	1926	Buff
	3	17.53	8.89	1.97	2.39	8.89	3.06	2420	Buff
	5	16.86	8.45	2.00	2.40	9.43	3.27	2607	Buff
	7	20.95	11.87	1.77	2.23	—1.58	—.54	3434	Brown
J91 2	02	12.08	6.43	1.88	2.14	11.95	4.17	Cr.	Dull red Cr. St. H.
	1	13.21	7.23	1.83	2.07	9.49	3.27	Cr.	Dull red Cr.
J91 3	02	15.30	8.35	1.83	2.17	16.66	5.91	Cr.	Salmon gray Cr. St. H.
J92 P2	02	12.18	5.76	2.11	2.41	18.05	6.44	Cr.	Reddish buff Cr. St. H.
	1	13.58	6.53	2.08	2.41	16.63	5.91	Cr.	Reddish buff Cr.
	3	12.05	5.62	2.14	2.44	19.05	6.82	Cr.	Reddish buff Cr.
	5	11.74	5.53	2.14	2.44	18.36	6.55	Cr.	Reddish buff Cr.
	7	22.67	14.04	1.62	2.08	—6.35	—2.18	Cr.	Dk. buff Cr.
	9	10.65	5.83	1.83	2.05	6.65	2.29	Cr.	Dk. buff Cr.
J106 4	02	16.82	8.52	1.97	2.37	12.38	4.32	Cr.	Dull red St. H.
	1	17.36	8.76	1.98	2.39	12.77	4.46	Cr.	Dull red
	3	17.23	8.62	2.00	2.41	13.23	4.65	Cr.	Dull red Cr.
	5	17.76	9.03	1.97	2.39	12.37	4.32	Cr.	Dull red
	7	33.96	30.34	1.13	1.73	—53.01	—22.36	Cr.	Brown Bl.

Abbreviation: St. H., steel hard; Bl., bloated; Cr., cracked.

POSSIBILITIES FOR UTILIZATION

The clays in this group are generally of marine origin. Their drying shrinkage is excessive, and on burning they crack to such an extent that they are not suitable for ceramic purposes. Sample J88-4 does have good burning characteristics over an adequate but limited firing range; however, the clay is badly stained with calcium salts and would be limited in its use. Common brick, drain tile, and hollow partition tile are possibilities.

Samples J137-7 and J139-6 were tested in the usual manner, but on burning to cone 02 the test pieces disintegrated. No data are reported for these clays except the chemical analysis of Sample J137-7 and this under the heading of "Miscellaneous chemical analyses."

MISCELLANEOUS CHEMICAL ANALYSES*

SAMPLE J4—5

Ignition loss 14.80	Iron oxide, Fe_2O_3 . 5.16	Magnesia, MgO .. 2.00
Silica, SiO_2 ......51.65	Titania, TiO_2 .... 0.78	Manganese, MnO_2 None
Alumina, Al_2O_3 ..22.96	Lime, CaO 1.11	Alkalies, (K_2O, Na_2O) 0.57

SAMPLE J27—2

Ignition loss 15.91	Titania, TiO_2 .... 0.69	Manganese, MnO_2. 0.19
Silica, SiO_2 ......41.97	Lime, CaO 17.16	Alkalies, (K_2O, Na_2O) 0.25
Alumina, Al_2O_3 ..15.61	Magnesia. MgO .. 1.81	Sulfur, SO_3 ...... 2.61
Iron oxide, Fe_2O_3. 5.97		

SAMPLE J97—2

Ignition loss 6.49	Iron oxide, Fe_2O_3. 4.29	Magnesia, MgO .. 0.78
Silica, SiO_2 ......65.42	Titania, TiO_2 .... 1.08	Manganese. MnO_2 None
Alumina, Al_2O_3 ..20.13	Lime, CaO 0.69	Alkalies, (K_2O, Na_2O) 0.47

SAMPLE J137—7

Ignition loss 10.24	Iron oxide. Fe_2O_3. 5.16	Magnesia, MgO .. 1.21
Silica, SiO_2 ......59.83	Titania, TiO_2 .... 0.89	Manganese, MnO_2 None
Alumina, Al_2O_3 ..20.44	Lime, CaO 1.21	Alkalies, (K_2O, Na_2O) 0.43

*Samples ground through 100 mesh screen.

B. F. Mandlebaum, analyst.

LABORATORY PROCEDURE

PREPARATION

Preliminary drying of the clays was unnecessary, for they had been collected in the field and stored in a steam-heated laboratory several months prior to testing. Primary samples of about 200 pounds were crushed in a No. 2 jaw crusher. The crushed material was screened through a No. 20-mesh Tyler standard screen; residue coarser than 20-mesh was ground in a burr mill until it passed the 20-mesh screen. The clay which had passed 20-mesh screen was thoroughly mixed and reduced to a 10-pound sample by coning and quartering. This operation was accomplished in a metal lined tray approximately 4 feet square and 8 inches deep. The 10-pound sample was reserved for screen analysis, chemical analysis, and for making pyrometric cones. Approximately 75 pounds of clay from the remainder was mixed with water and kneaded by hand to a plastic consistency. The plastic mass was divided into small portions and thoroughly wedged to remove entrapped air and to develop a homogenous plastic body. The small portions were recombined in the same manner and stored in a metal lined damp box until used for making test pieces.

FORMING OF TEST PIECES

Test pieces were of two sizes: short bars, 1 inch square by 2 inches long, and long bars, 1 inch square by 7 inches long. The test pieces were made by wire-cutting bars of approximate size from the plastic mass and pressing in molds to the final size. The long bars were pressed by hand in a hardwood mold of the plunger type. The short bars were formed in a Patterson screw press fitted with a steel die. Each test piece was identified as to test hole number, sample number, and individual piece number. The identification was made by stamping the necessary letters and numerals on the test pieces. A shrinkage mark of 10 centimeters was stamped on the long bars. Sixty long bars and thirty short bars were made from each primary clay sample. Certain samples were not large enough to make the full number of test pieces.

PLASTIC, DRY, AND WORKING PROPERTIES

Immediately on forming the short bars their plastic volume was determined in a mercury volumeter. The plastic weight was measured to .01 gram using a triple beam balance. All of the test pieces were allowed to air-dry several days on slatted wooden pallets and then oven-dried by gradually increasing the temperature of the oven from room temperature to 100°C. in 4 hours and maintaining the oven temperature between 100°C. and 110°C. for an additional hour. After drying, the short bars were placed in desiccators, and on cooling to room temperature they were reweighed, and their volume was determined as above described. Five long bars were broken on a Fairbanks cross-breaking machine to determine modulus of rupture.

The workability of the clay was observed during grinding, wedging, and the forming of the test pieces. The water of plasticity, modulus of rupture, and volume shrinkage were calculated by methods outlined by the American Ceramic Society. The linear shrinkage was calculated from the volume shrinkage and is based on the dry volume.

FIRED PROPERTIES

The long and short bars were burned in a down-draft surface combustion kiln especially designed for the purpose. Butane gas was used for fuel. Oxidizing conditions were maintained in the kiln during the entire period

CONVERSION TABLE
CONES TO TEMPERATURES

Cone No.	When fired slowly, 20°C. per hour		When fired rapidly, 150°C. per hour	
	°C	°F	°C	°F
010	890	1,634	895	1,643
09	930	1,706	930	1,706
08	945	1,733	950	1,742
07	975	1,787	990	1,814
06	1,005	1,841	1,015	1,859
05	1,030	1,886	1,040	1,904
04	1,050	1,922	1,060	1,940
03	1,080	1,976	1,115	2,039
02	1,095	2,003	1,125	2,057
01	1,110	2,030	1,145	2,039
1	1,125	2,057	1,160	2,120
2	1,135	2,075	1,165	2,129
3	1,145	2,093	1,170	2,138
4	1,165	2,129	1,190	2,174
5	1,180	2,156	1,205	2,201
6	1,190	2,174	1,230	2,246
7	1,210	2,210	1,250	2,282
8	1,225	2,237	1,260	2,300
9	1,250	2,282	1,285	2,345
10	1,260	2,300	1,305	2,381
11	1,285	2,345	1,325	2,417
12	1,310	2,390	1,335	2,435
13	1,350	2,462	1,350	2,462
14	1,390	2,534	1,400	2,552
15	1,410	2,570	1,435	2,615
16	1,450	2,642	1,465	2,669
17	1,465	2,669	1,475	2,687
18	1,485	2,705	1,490	2,714
19	1,515	2,759	1,520	2,768
20	1,520	2,768	1,530	2,786

Cone No.	When heated at 100°C. per hour		Cone No.	When heated at 100°C. per hour	
	°C	°F		°C	°F
23	1,580	2,876	32	1,700	3,092
26	1,595	2,903	33	1,745	3,173
27	1,605	2,921	34	1,760	3,200
28	1,615	2,939	35	1,785	3,245
29	1,640	2,984	36	1,810	3,290
30	1,650	3,002	37	1,820	3,308
31	1,680	3,056	38	1,835	3,335

The properties and uses of pyrometric cones: The Standard Pyrometric Cone Company, Columbus, Ohio.

of firing. The test pieces were stacked criss-cross in the kiln to permit complete circulation of gases. The kiln was fired at the rate of 200°F. per hour to within 200°F. of the maximum temperature. The last 200°F. rise was accomplished in two to three hours. The rate of firing was measured by means of a Chromel-Alumel thermocouple up to 2,100°F., at which point the couple was withdrawn from the kiln; and, by means of pyrometric cones above 2,100°F.

On completing the firing of the long and short test pieces the kiln was cooled gradually in twenty-four to thirty-six hours, after which the short bars were immediately placed in desiccators and weighed to an accuracy of .01 gram on a triple beam balance. After weighing, the bars were placed in water which was then heated to the boiling point and was kept boiling for four hours. They were allowed to cool in the water to room temperature and were reweighed as before mentioned. Immediately thereafter the volumes of the test pieces were determined in a mercury volumeter. Volume shrinkage, porosity, absorption, bulk specific gravity, and apparent specific gravity were calculated in accordance with methods outlined by the American Ceramic Society. The long bars were broken on a Fairbanks testing machine to determine modulus of rupture. Five long bars were burned and tested for each clay at each cone temperature indicated in the table of pyrophysical properties. Three short bars were fired as test pieces for each clay at each cone temperature.

SCREEN ANALYSES

A quantity of clay from each quartered sample was dried at 110°C.—constant-weight, after which exactly 100 grams were blunged in approximately two liters of water by pouring the slip back and forth until all the substance apparently disintegrated.

The disintegrated clay in slip form was poured through a nest of Tyler standard screens, the sizes being 60, 100, and 250. The material passing through the 250-mesh screen was caught on a cloth in a plaster vat. After a fair sample was caught on the cloth, the screens, still in nest, were then washed with a stream of water until no further material passed through the screens. The screens were dried at 110°C., after which the residue from each screen was weighed and collected in glass vials for further study.

It is evident that the above treatment would not completely disintegrate all of the clay nodules; and, though this could have been accomplished by blunging with rubber balls, it was not the purpose of this screen analysis to break the clay down to a finer state of division than would ordinarily occur in usual commercial blunging procedure; consequently, the screen analyses will show residue as "clay nodules" which indicates that a very thorough blunging will be necessary to disintegrate completely the clay in commercial use.

The residue from each screen was examined carefully under a binocular microscope. The finer material was examined under a petrographic microscope. Determinations were made from the physical appearances of mineral grain and crystal form corroborated by use of physical properties test, magnetized needle, reactions to wet reagents; and, where grain size permitted, blow pipe analyses were made.

Undoubtedly there were minerals present in the clays that could not be distinguished under the microscope, because of their fine state of division. However, those that have been recorded have been definitely identified.

Terms used in the tables of screen analyses for describing quantity of residue are: "abundance," meaning one-half or more of residue on screen; "considerable quantity," between one-fourth and one-half; "small amount," less than one-fourth; and "trace," few grains scattered throughout residue.

CHEMICAL ANALYSES

Grinding: Samples were ground to pass a 100 mesh screen.

Ignition loss: One gram of each sample was heated in a platinum crucible at full heat of a blast burner for one hour.

Silica: Ignited samples were fused with 6 to 8 times their weight of anhydrous sodium carbonate, and the fusion dissolved in dilute hydrochloric acid. The samples were double dehydrated with hydrochloric acid. The silica was filtered off, washed, ignited, weighed, volatilized by hydrofluoric acid, and the crucible reweighed. SiO_2 was found by loss in weight. Any residue after evaporation was fused with sodium carbonate and dissolved in the original filtrate for alumina determination.

Alumina: Alumina, iron, and titania were precipitated together by ammonium hydroxide in the presence of ammonium chloride. Double precipitations were necessary to remove all the chlorides. The mixed hydroxides were filtered off, washed free of chlorides, ignited and weighed. The weight represents the total of alumina, iron, and titania. The mixed oxides were fused with potassium bisulphate and dissolved in dilute sulphuric acid. In some cases small amounts of silica were recovered by filtration, ignition, and volatilization with hydrofluoric acid. This was added to silica and deducted from alumina.

Iron: An aliquot of the solution of bisulfate solution was reduced with aluminum dust in sulphuric acid solution and titrated with standard potassium permangate solution. The iron was calculated as Fe_2O_3.

Titania: Another aliquot of the bisulfate solution was placed in a Schreiner type colorimeter tube and a few drops of hydrogen peroxide added. This was compared in color with a standard titania solution. The total of iron and titania was subtracted from the mixed precipitate of alumina, iron, and titania, leaving alumina.

Manganese: Manganese was removed from the sample used for the ultimate analysis, but discarded, and the determination was made on a separate larger sample. The sample was treated with hydrofluoric acid, twice evaporated, and the insoluble residue removed by filtering. Manganese was determined colorimetrically using potassium periodate as the color reagent, and matching against a standard color sample.

Lime: Lime was determined from the filtrate of the manganese determination by precipitation as the oxalate in the presence of ammonium acetate in alkaline solution. It was weighed as CaO.

Magnesia: Magnesia was determined from the lime filtrate by precipitation as mixed ammonium phosphate in alkaline solution. It was ignited and weighed as $Mg_2P_2O_7$, and calculated to MgO.

Alkalies: Alkalies were determined by the J. Lawrence Smith method as outlined in Scott "Standard Methods of Chemical Analysis." Sodium and potassium were not separated but reported as combined oxides.

Duplicates were made on all samples and the average was reported.

TEST HOLE REFERENCES

Test hole No.	Sample tested	PROPERTY	PAGES: Stratigraphic log	PAGES: Ceramic tests	PAGES: Chemical analysis	GEOLOGICAL UNITS: Alluvium	Pleistocene terraces	Citronelle	Forest Hill	Yazoo clay	Moodys Branch	Yegua	Wautubbee	Kosciusko
J4	P5	Adams Edgar Lbr. Co.	78		121	o				x				
J5A	P3	Stuart, Henry	79	106, 108				x	o					
J6	P3	Stuart, Henry	80	106, 108				x						
J8	P3	Stuart, Henry	81	106-108	107			x						
	P6			106-108	107			x						
	P8			109, 110, 112	111			x						
J8B	P3	Stuart, Henry	82	109, 112				x						
J8C	P3	Stuart, Henry	83	106, 108				x						
J19	P2-3	Stuart, Hilton	84	109, 112				o	x					
J21	P2	Cooper, W. G.	84	109, 110, 112	111				x					
	P3			119, 120	119	o			x					
J22	P4	Stuart, John	85	109, 110, 112	111			x						
	P5			109, 110, 112	111			x						
J24	P2	Stuart, Hilton	86	109, 113				x						
	P6			114-116					x					
J25	P3	Stuart, Hilton	87	109, 113				x						
	P4			109, 113					x					
J26		Stegal, W. B.	48			o			x					
J27	P2	U. S. Government	87	116, 118	121				o	x				
J28		Bradshaw, A.	49			o			o					
J30		Smith, J. H.	50						o	o				
J32		Mize, R. M.	50						o	o				
J34		Foster, T. E.	51					o	o					
J41	P3	Regions, Jim	88	114-116	115			o	o					
J85	P2	Ueltchey, Casper	89	119, 120						x				
	P3-4			119, 120		o				x				

TEST HOLE REFERENCES

Test hole No.	Sample tested	PROPERTY	PAGES: Stratigraphic log	PAGES: Ceramic tests	PAGES: Chemical analysis	GEOLOGICAL UNITS: Alluvium	Pleistocene terraces	Citronelle	Forest Hill	Yazoo clay	Moodys Branch	Yegua	Wautubbee	Kosciusko
J85A	P1	Copeland, J. A.	89	114-116						x				
J86	P2-3	U. S. Government	90	114-116	115					x				
	P4			116, 118	117					x				
	P5-7			116, 118	117					x				
J88	P2	Dumas, D.	91	119, 120								x		
	P4			119, 120								x		
J89	P1	Baker, R. C.	92	116-118	117					x				
	P2-3			116-118	118					x				
J91	P2	Miles, Will	92	119, 120						x				
	C3			119, 120						x				
J92	P2	Caldwell, J. A.	93	119, 120									x	
J97	P2	Harkey, A. W.	94	109, 113	121								x	
J100	P3	Fountain, J. J.	94	114-116		o						x		
J106	P4	McCraw, A. A.	95	119, 120									x	
J117	P3	McCan, Walter	96	104-106	105		x							o
J118	P3	Bolware, M.	97	109, 113									x	
J121		Warren, Joe	27				o					o	o	
J135A	P3	Saxon, E. C.	98	104-106		o						x		
J137	P7	Simmons, Perry	37 99	121	121	o				o	o	x		
J151	P4	Gunn, Robe	100	104-106	105	o						x		
J161		Eady, A. A.	15*											
J163		Public	38			o				o	o	o		
J166		Dearman, S. A.	38							o	o	o		
J168		Christian, W. M.	36							o	o	o		
J192		Public	39			o				o	o	o		
J193		Armstrong, Jack	39			o				o	o	o		

x Sample tested
o Penetrated
* Cited

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MISSISSIPPI
STATE GEOLOGICAL SURVEY

WILLIAM CLIFFORD MORSE, Ph.D.
DIRECTOR

BULLETIN 49

SCOTT COUNTY

FOSSILS

JACKSON FORAMINIFERA AND OSTRACODA

By

HARLAN RICHARD BERGQUIST, Ph.D.

UNIVERSITY, MISSISSIPPI
1942

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ILLUSTRATIONS

SCOTT COUNTY FOSSILS

JACKSON FORAMINIFERA AND OSTRACODA

HARLAN RICHARD BERGQUIST, PH.D.

INTRODUCTION

This report on the foraminifera and ostracoda from the Jackson formation in Scott County is a summation of a study of several hundred samples obtained from test holes drilled by a field crew under the writer's supervision in the summer and fall of 1940 and the winter of 1941. Numerous hand auger test holes, drilled along the strike to determine the limits of the formation and drilled across the dip for stratigraphic study, yielded unweathered fossiliferous material usually not obtainable. The lithology of the formation has been discussed in the geological portion of this bulletin.

A total of 225 species and varieties of foraminifera found in the Scott County samples is described and illustrated. Of this number, 34 are reported for the first time from the Jackson formation, 5 are new species, and 4 are new varieties. Fourteen species reported by Cushman[1] from the Jackson in other areas in the state are listed in the text. Ostracoda are very meagerly represented in the Scott County Jackson material by 17 species and 2 varieties, whereas many more have been reported by Monsour[2] from the formation in eastern Mississippi.

The Jackson formation has been studied very widely throughout the Gulf Coast, and several papers have been published on its foraminifera. This report, however, is the first study of the microfauna of the state undertaken by the Mississippi Geological Survey, and publication of these data is intended as a guide to a partial list of the foraminifera and as an aid in the identification of those likely to be found in the Jackson material in this state. Had more time been available, the study, which was started in May and finished in September 1942, would have included, as a comprehensive report, material throughout the

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1. Cushman, Joseph A., Upper Eocene Foraminifera of the Southeastern United States, U. S. Geol. Survey Prof. Paper 181, 1935.
2. Monsour, Emil, Micro-Paleontologic Analysis of Jackson Eocene of Eastern Mississippi, Bull. Am. Assoc. Petr. Geol. Vol. 21, No. 1, pp. 80-96, 1937.

Jackson belt in Mississippi. It is, accordingly, not a complete record of the Jackson microfauna of the state.

Most of the material studied was prepared in the laboratory by James E. King who separated specimens from the washed samples and made preliminary mounts. Margarita Weyerstall Mills did most of the permanent mounting of specimens and assembled the illustrated plates. All illustrations were made by Mary Louise Pegues. To each of these persons the writer expresses his appreciation for the interest and efficiency shown toward the work.

STRATIGRAPHY

The Jackson formation in Scott County, which is uncomformably underlain by the Yegua formation and uncomformably overlain by the Forest Hill formation, consists of two members: a lower Moodys Branch marl and an upper Yazoo clay.

The Moodys Branch member, which has a maximum thickness of 20 feet, is a greenish-gray glauconitic clay-marl in the upper part and a glauconitic, pyritiferous sand in the lower part. It contains abundant foraminifera and mollusk shells.

The Yazoo clay member consists of calcareous, montmorillonitic greenish-gray clays, slightly glauconitic in the lower part. It has a maximum thickness of 340 feet.

Although the Moodys Branch marl and the Yazoo clay contain a great number of species of microfossils that range throughout both members, each member contains forms of limited range that may be used for stratigraphic delimitation.

The Moodys Branch marl contains in its fauna the following species that are confined to this member or to it and the overlying lower Yazoo clay:

Textularia adalta Cushman
    recta Cushman
Quinqueloculina anguina Terquem
Articulina terquemi Cushman (rare)
Miliola jacksonensis Cushman (rare)
    saxorum Lamarck (rare)
Triloculina rotunda d'Orbigny var. (rare)
Cornuspira olygogyra Hantken
Robulus limbosus (Reuss) var. hockleyensis (Cushman and Applin)
Marginulina multiplicata Bergquist

Nodosaria latejugata Gumbel (rare)
Sigmomorphina jacksonensis (Cushman)
jacksonensis (Cushman) var. costifera Cushman and Ozawa
Nonion planatum Cushman and Thomas
Nonionella hantkeni (Cushman and Applin) var. spissa Cushman
Bitubulogenerina montgomeryensis Howe (rare)
Discorbis globulo-spinosa Cushman
Cassidulina winniana Howe
Globorotalia cocoaensis Cushman
Cibicides lobatulus (Walker and Jacob) var. ?
Gypsina globula (Reuss) var. ?
Cythereis hysonensis Howe and Chambers var. dohmi Howe and Chambers (rare)

The lower Yazoo clay contains in its fauna the following species which are restricted either to it alone or to it and the underlying Moodys Branch marl:

Textularia adalta Cushman
cf. dibollensis Cushman and Applin (rare)
mississippiensis Cushman var. alabamensis Cushman (rare)
mississippiensis Cushman var. elongata Davis
mississippiensis Cushman var. rhomboidea Cushman and Ellisor
recta Cushman
subhauerii (?) Cushman (rare)
Karreriella mauricensis Howe and Ellis (rare)
Quinqueloculina anguina Terquem (rare)
bicarinella Reuss (rare)
tessellata Cushman (rare)
Massilina mauricensis Howe and Ellis (rare)
Spiroloculina grateloupi d'Orbigny
Triloculina rotunda d'Orbigny var. (rare)
Cornuspira olygogyra Hantken
Robulus arcuato-striatus (Hantken) var. carolinianus Cushman
clericii (Fornasini) (rare)
cultratus Montfort
dumblei Weinzierl and Applin
limbosus (Reuss) var. hockleyensis (Cushman and Applin)
Planularia danvillensis Howe and Wallace var. yazooensis Bergquist
Marginulina havanensis Cushman and Bermudez (rare)
multiplicata Bergquist
Dentalina multilineata (?) Bornemann (rare)
sp. (B) (rare)
Nodosaria fissicostata (Gumbel)
latejugata Gumbel (rare)
latejugata Gumbel var. carolinensis Cushman

Frondicularia tenuissima Hantken (rare)
Lagena costata (?) (Williamson) (rare)
globosa (Montagu) (rare)
sulcata (Walker and Jacob) var. semiinterupta Berry
sp. (A) Howe and Walker
Globulina gibba d'Orbigny var. globosa (Von Munster)
gibba d'Orbigny var. tuberculata d'Orbigny
inaequalis Reuss (rare)
minuta (Roemer)
Sigmomorphina jacksonensis (Cushman)
Polymorphina advena Cushman (rare)
frondea (Cushman) var. ?
Nonion advenum (Cushman) (rare)
planatum Cushman and Thomas
Nonionella hantkeni (Cushman and Applin) var. spissa Cushman
Amphimorphina yazooensis Bergquist
Buliminella cf. bassendorfensis Cushman and Parker
Robertina subteres (H. B. Brady) var. angusta (Cushman)
Entosolenia incurvata (?) Green (rare)
marginata (Walker and Boys) (rare)
Virgulina recta (?) Cushman (rare)
Bolivina attenuata Cushman (rare)
gardnerae Cushman
Bitubulogenerina howei Cushman (rare)
montgomeryensis Howe (rare)
Tritubulogenerina mauricensis Howe (rare)
Reussella rectimargo (Cushman)
cf. subrotundata (Cushman and Thomas)
Uvigerina cookei Cushman
Angulogerina rugoplicata Cushman
Pleurostomella cubensis Cushman and Bermudez
Ellipsolagena sp. (rare)
Discorbis assulata (?) Cushman (rare)
globulo-spinosa Cushman
hemisphaerica Cushman
Gyroidina sp. (rare)
Cymbaloporetta (?) squammosa (d'Orbigny) (rare)
(?) squammosa (d'Orbigny) var. (rare)
Cassidulina winniana Howe
Globigerina sp. (A) Howe and Wallace
Hantkenina danvillensis Howe and Wallace (rare)
Globorotalia centralis Cushman and Bermudez
cocoaensis Cushman
Cibicides americanus (Cushman) var. antiquus (Cushman and Applin)
yazooensis Cushman
Paracypris franquesi Howe and Chambers

Cytheropteron montgomeryensis Howe and Chambers (rare)
Cythereis broussardi Howe and Chambers (rare)
florienensis Howe and Chambers (rare)
hysonensis Howe and Chambers var. dohmi Howe and Chambers (rare)
(?) israelskyi Howe and Pyeatt var. morsei Howe and Pyeatt (rare)
(?) jacksonensis Howe and Pyeatt
yazooensis Howe and Chambers (rare)
Loxoconcha jacksonensis Howe and Chambers
Cytheromorpha ouachitaensis Howe and Chambers
Brachycythere watervalleyensis Howe and Chambers

The upper Yazoo clay contains in its fauna the following species which are confined entirely to the upper part:

Textularia danvillensis Howe and Wallace (rare)
hockleyensis Cushman and Applin var.
mississippiensis Cushman var.
ouachitaensis Howe and Wallace
Gaudryina jacksonensis Cushman (rare)
Dorothia principensis Cushman and Bermudez (rare)
Massilina pratti Cushman and Ellisor (rare)
Pyrgo inornata (d'Orbigny) var. danvillensis Howe and Wallace
Robulus mayi Cushman and Parker (rare)
wilcoxensis Cushman and Ponton (rare)
Planularia catahoulaensis Howe and Wallace (rare)
danvillensis Howe and Wallace (rare)
ouachitaensis Howe and Wallace var. (rare)
Marginulina triangularis d'Orbigny var. danvillensis Howe and Wallace
Dentalina basitorta Cushman
cf. catenulata Brady (rare)
consobrina d'Orbigny var. emaciata Reuss
subspinosa (?) Neugeboren (rare)
Nodosaria longiscata d'Orbigny
pyrula d'Orbigny var. longi-costata (?) Cushman
Pseudoglandulina laevigata (d'Orbigny)
Lagena striata (Montagu) cf. var. interrupta Williamson (rare)
striata (d'Orbigny) var. strumosa Reuss (rare)
Globulina rotundata (Bornemann)
Gumbelina cubensis Palmer var. heterostoma Bermudez
Plectofrondicularia mexicana (Cushman) (rare)
Buliminella elegantissima (d'Orbigny) (rare)
Virgulina recta Cushman var. howei Cushman (rare)
Bolivina mexicana Cushman
Uvigerina danvillensis Howe and Wallace
glabrans Cushman
yazooensis Cushman

Angulogerina danvillensis Howe and Wallace
multicostata Bergquist
multicostata Bergquist var. yazooensis Bergquist
Cancris danvillensis Howe and Wallace
Ceratobulimina alazanensis Cushman and Harris
Chilostomella cylindroides Reuss (rare)
Chilostomelloides oviformis (Sherborn and Chapman) (rare)
Anomalina granosa (Hantken) var. dibollensis Cushman and Applin (rare)
Planulina cocoaensis Cushman var. cooperensis Cushman
Cibicides ouachitaensis Howe and Wallace
Cibicidella sp. (rare)
Cytherelloidea danvillensis Howe var.
Cythereis (?) israelskyi Howe and Pyeatt var. warneri Howe and Pyeatt (rare)

DESCRIPTION OF FORAMINIFERA

FAMILY TEXTULARIIDAE

Genus TEXTULARIA Defrance, 1824

TEXTULARIA ADALTA Cushman

Plate I, 7, 9

Textularia adalta Cushman, Contr. Cushman Lab. Foram. Res., Vol. 2, p. 29, pl. 4, figs. 2a, b, 1926. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 6, fig. 2, 1933. Plummer, Texas Univ. Bull. 3232, p. 696, 1932. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 8, pl. 1, figs. 11, 12, 1935. Davis, Jour. Pal., Vol. 15, no. 2, p. 147, pl. 24, figs. 1, 2a, b, 1941.

"Test elongate, slender, early portion tapering and compressed, adult portion thicker and with the sides nearly parallel, periphery subacute except in the last few chambers, which are rounded; chambers numerous, the last 5 or 6 making up half the test, earlier ones indistinct, low and broad, later ones more inflated, higher; sutures distinct, especially in the later portion, where they are somewhat depressed, usually oblique; wall finely arenaceous, only slightly roughened; aperture a high, arched opening in the central part of the base of the apertural face. Maximum length 2.00 mm."

A number of good specimens of this species came from lower Yazoo clay and Moodys Branch marl samples from Scott County.

TEXTULARIA CUYLERI (?) Davis

Plate I, 10a, 10b

Textularia cuyleri Davis, Jour. Pal., Vol. 15, no. 2, p. 147, pl. 24, figs. 3a, b, 4, 1941.

"Test short, increasing in size from a pointed apex to a broad apertural end; chambers low, increasing in size with each newly added chamber; walls coarsely arenaceous but showing a fine base when worn down; aperture a broad arch at base of inner margin of last formed chamber; periphery sub-acute. Length 0.53 mm."

A number of small specimens exhibit features similar to the species recently described from Texas. It appears to range through the Jackson formation in Scott County.

TEXTULARIA DANVILLENSIS Howe and Wallace

Plate I, 6

Textularia danvillensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 18, pl. 1, figs. 2a, b, 4a, b, 1932.

"Test elongate, tapering, about twice as long as broad; edges broadly rounded; chambers numerous, often seventeen or more showing, in the early stages very slightly inflated, but becoming more so as chambers are added, adult chambers inflated most near the junction with the preceding chamber below; sutures depressed, not oblique; wall finely arenaceous; aperture a slit at the base of the last-formed chamber at the terminal end of the test, its length being about equal to one-third of the thickness of the test. Length 0.7 mm.; width 0.4 mm.; thickness 0.22 mm."

This is a characteristic species and easily distinguishable. It was found sparingly in two samples of upper Yazoo clay from Scott County.

TEXTULARIA cf. DIBOLLENSIS Cushman and Applin

Textularia dibollensis Dumble (nomen nudum), Bull. Am. Assoc. Petr. Geol., Vol. 8, p. 443, 1924.

Textularia dibollensis Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 165, pl. 6, figs. 12-14, 1926. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, p. 1301, pl. 1, fig. 4, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 8, pl. 1, figs. 13-16, 1935. Davis, Jour. Pal., Vol. 15, no. 2, p. 148, pl. 24, figs. 7a, b, 1941.

"Test small, short, and broad, moderately compressed, margin subacute, initial end rounded; apertural end broadly truncate; chambers few, rather indistinct, rapidly increasing in breadth as added, becoming high in the adult, with the sides nearly parallel, the last four usually making up at least half of the test; sutures indistinct, not depressed, at right angles to the peripheral margin; wall finely arenaceous; aperture an arched opening, low and broad, at the inner margin of the last-formed chamber, the apertural face of the chamber evenly rounded. Maximum length 0.80 mm., usually much shorter; breadth 0.03 mm."

Lower Yazoo clay samples from Scott County test holes yielded a few specimens that are tentatively placed with this species. The specimens are relatively smooth and the sutures barely distinguishable.

TEXTULARIA DIBOLLENSIS Cushman and Applin var. HUMBLEI Cushman and Applin

Plate I, 13

Textularia dibollensis Cushman and Applin var. *humblei* Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 8, p. 443, 1926; idem., Vol. 10, p. 165, pl. 6, fig. 9, 1926. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 8, pl. 1, figs. 17a, b, 1935. Davis, Jour. Pal., Vol. 15, no. 2, p. 148, pl. 24, figs. 9a, b, 1941.

Variety differs from the typical in being larger, more elongate and symmetrical with the greatest width at the apertural end; sutures are more distinct and somewhat depressed; periphery is somewhat acute.

Specimens referred to this variety show variations; on some the sutures are distinct, but on others, which appear to be somewhat worn, they are not readily distinguishable; peripheries subacute, either regular in outline or somewhat indented. Most of the specimens from Scott County came from lower Yazoo clay samples.

TEXTULARIA DISTORTIO Cushman and Applin

Textularia hockleyensis var. *distortio* Dumble (nomen nudum), Bull. Am. Assoc. Petr. Geol., Vol. 8, p. 443. 1924.

Textularia distortio Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 164, pl. 6, figs. 7, 8, 1926. Cushman. U. S. Geol. Survey Prof. Paper 181, p. 8, pl. 1, figs. 18, 19, 1935.

This small irregular form was not found in the Scott County Jackson samples, but it has been noted in well cuttings from artesian wells drilled in the Yazoo Basin of Mississippi.

TEXTULARIA HOCKLEYENSIS Cushman and Applin var.

Plate I, 18, 20

Textularia hockleyensis Dumble (nomen nudum), Bull. Am. Assoc. Petr. Geol., Vol. 8, p. 443, 1924.

Textularia hockleyensis Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 164, pl. 6, figs. 3-6, 1926. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 1, fig. 7, 1933.

Textularia hockleyensis Cushman and Applin var.? Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 19, pl. 1, figs. 5a, b, 1932. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 9, pl. 1, figs. 20, 21, 1935.

"Test comparatively large, tapering, compressed, the central portion thickest, thence with a depressed area between the center and the periphery; periphery thin, but rounded; chambers numerous, distinct; sutures distinct, and toward the central portion often somewhat limbate, strongly curved, especially toward the periphery; wall arenaceous, but smoothly finished, in end view, rhomboid; the aperture much curved, low. Length, up to 3.00 mm.; breadth, up to 1.25 mm."

Several smoothly arenaceous specimens with distinctly marked and curved sutures seem to compare most closely with the variety illustrated by Howe and Wallace from the Jackson formation at Danville Landing, Louisiana. The only specimens were in a sample 20 feet beneath the surface in test hole J43, drilled in the upper Yazoo clay on the J. P. Donald property (NW.1/4, SE.1/4, NE.1/4, Sec. 35, T.6 N., R.6 E.).

TEXTULARIA MISSISSIPPIENSIS Cushman

Plate I, 2, 4

Textularia mississippiensis Cushman, U. S. Geol. Survey Prof. Paper 129, pp. 90, 125, pl. 14, fig. 4, 1922; Prof. Paper 133, p. 17, 1923. Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 166, pl. 6, figs. 10, 11, 1926. Cushman and Thomas, Jour. Pal., Vol. 3, p. 177, pl. 23, figs. 1a, b, 1929. Cushman, Contr. Cushman Lab. Foram. Res., Vol. 5, p. 79, pl. 12, fig. 5, 1929. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 19, pl. 1, figs. 7a, b, 1932. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 7, pl. 1, figs. 3, 4, 1935.

"Test elongate, fairly broad, thickest in the middle, thence thinning toward the periphery, in end view biconvex, central portion curved; chambers rather low and broad, especially in the early stages, becoming somewhat higher in the adult; sutures covered by a coarsely arenaceous layer, meeting in the center and at the periphery, leaving the central portion of each chamber uncovered; periphery irregular, not definitely or regularly spinose, chamber walls smooth and finely perforate. Length 0.40-0.75 mm."

Specimens show variations from the typical form to the varieties. Many are darkened by mineral matter and have pyritized arenaceous material forming the raised portion along the sutures. This is a common form in both the Jackson and Vicksburg formations of the state. It was found in many Scott County samples that ranged throughout the Jackson.

TEXTULARIA MISSISSIPPIENSIS Cushman var. ALABAMENSIS Cushman

Textularia mississippiensis Cushman var. *alabamensis* Cushman, U. S. Geol. Survey Prof. Paper 133, p. 17, pl. 1, fig. 4, 1923; idem., Prof. Paper 181, p. 7, pl. 1, figs. 5, 6, 1935. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 1, fig. 6, 1933. Davis, Jour. Pal., Vol. 15, no. 2, p. 150, pl. 25, figs. 2a, b, 3, 1941.

"Variety differing from the typical species in the more elongate form, somewhat thicker test, especially in the center, the less well-defined peripheral carina, and the sutures excavated instead of being covered by an arenaceous layer."

This form was found rarely in lower Yazoo clay samples from Scott County. Cushman has reported this species from a hill above the pumping station at Jackson.

TEXTULARIA MISSISSIPPIENSIS Cushman var. ELONGATA Davis

Plate I, 1, 3

Textularia mississippiensis Cushman var. *elongata* Davis, Jour. Pal., Vol. 15, no. 2, p. 151, pl. 24, figs. 21a, b, 22, 1941.

"Test very elongate, gradually tapering; chambers numerous, low, slightly depressed; sutures raised, covered with finely arenaceous material, curved downward with pronounced curving close to periphery; periphery slightly serrate and thin; aperture an oval-shaped opening at base of last formed chamber. Length 0.95 mm.

"Differs from *T. mississippiensis* in having a sharp periphery and in being slimmer and longer."

This variety described from the Whitsett (upper Jackson) beds of Texas is found in a few lower Yazoo clay samples from Scott County.

TEXTULARIA MISSISSIPPIENSIS Cushman var. RHOMBOIDEA Cushman and Ellisor

Plate I, 5

Textularia mississippiensis Cushman var. *rhomboidea* Cushman and Ellisor, Contr. Cushman Lab. Foram. Res., Vol. 7, part 3, p. 52, pl. 7, figs. 2a, b, 1931. Idem, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 1, figs. 2a, b, 1933. Davis, Jour. Pal., Vol. 15, no. 2, p. 151, pl. 24, figs. 18a, b, 20, 1941.

"Test elongate, thin, in end view biconvex; chambers low and broad, depressed, curved downward; sutures distinct, excavated;

walls smoothly arenaceous; periphery even and thin. Length 0.54-0.75 mm.

"This species is easily distinguished from *T. alabamensis* in its rhomboid outline and much compressed test."

Specimens referred to this variety have depressed sutures but median line of test is slightly raised. Peripheries are thinned to almost a keel and are somewhat irregular. All came from samples of lower Yazoo clay obtained in Scott County.

TEXTULARIA MISSISSIPPIENSIS Cushman var.

Plate I, 14, 19

Test compressed with a heavy median ridge of arenaceous or calcareous material which extends from it a short distance along each suture; chambers either projecting spine-like beyond the periphery or bordered by irregular thin carinae.

Specimens obtained from upper Yazoo clay samples from test holes located at a road intersection 1½ miles southeast of Morton and at a road bend approximately one mile northeast of Pulaski.

TEXTULARIA OUACHITAENSIS Howe and Wallace

Plate I, 11a, 11b

Textularia ouachitaensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 20, pl. 1, figs. 1a, b, 1932.

"Test elongate, tapering, in transverse section almost circular; chambers numerous, only those occupying the later two-thirds of the test being distinct and slightly inflated; sutures depressed, transverse; wall arenaceous; aperture a short, rectangular slit in the terminal end. Length 1.0 mm.; diameter 0.5 mm."

Specimens that are similar to the species described from the Danville Landing beds in Louisiana were found in a sample of upper Yazoo clay from a test hole 4 miles southwest of Morton.

TEXTULARIA RECTA Cushman

Plate I, 8

Textularia recta Cushman, U. S. Geol. Survey Prof. Paper 133, p. 17, pl. 1, fig. 2, 1923; Prof. Paper 181, p. 7, pl. 1, figs. 8, 9, 1935.

"Test elongate, slightly compressed, early portion rapidly increasing in diameter, later portion in the adult with the sides parallel for a large part of the test; chambers numerous; sutures distinct; wall thick, covered with agglutinated calcareous grains but when worn showing a coarsely perforated undertest; apertural end obliquely truncate; aperture in a deep depression at the base of the last-formed chamber. Maximum length of specimens 1.25 mm."

Samples of lower Yazoo clay and Moodys Branch marl from Scott County furnished a number of specimens that are identified as this species. It has been reported from the Jackson formation at Jackson and Garlands Creek.

TEXTULARIA SUBHAUERII (?) Cushman

Textularia subhauerii Cushman, U. S. Geol. Survey Prof. Paper 129, pp. 89, 126, pl. 14, figs. 2a, b; idem., Prof. Paper 133, p. 16, 1923; idem., Prof. Paper 181, p. 8, pl. 1, fig. 10, 1935. Davis, Jour. Pal., Vol. 15, no. 2, p. 152, pl. 25, figs. 15a, b, 1941.

"Test large, stout, elongate, early portion rapidly increasing in width with each newly added chamber, later adult portion with the sides nearly parallel, slightly lobulate; periphery rounded, but the median portion nearly flat; chambers 18 to 20, increasing in height as added, those of the later portion nearly as high as broad; sutures usually rather indistinct; wall coarsely arenaceous; aperture at the base of the inner margin of the chamber. Maximum length 2.00 mm."

A few specimens, none very well preserved, show characteristics similar to this species and have been questionably referred to it. These came from lower Jackson samples from Scott County. Cushman has identified the species from material from a locality on the Chickasawhay River, 1½ miles south of Shubuta.

TEXTULARIA sp.

Plate I, 17

Test small, tapering, somewhat compressed except for last pair of chambers; sutures indistinct for most of test; walls smooth, finely arenaceous; periphery subacute in early part, rounded on last chambers; aperture a low opening at base of last chamber.

FAMILY VERNEUILINIDAE

Genus GAUDRYINA d'Orbigny, 1839

GAUDRYINA JACKSONENSIS Cushman

Plate I, 16

Gaudryina jacksonensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 2, p. 33, pl. 5, figs. 1a, b, 1926. U. S. Geol. Survey Prof. Paper 181, p. 9, pl. 2, figs. 4-6, 1935.

"Test large, elongate, irregularly triangular in section, the angles subacute, triserial portion short, biserial portion triangular, angles subacute, almost carinate; chambers distinct, very slightly inflated; sutures distinct, slightly depressed; wall composed of fine sand grains with a large amount of cement, surface smoothly finished; aperture semi-circular, in a reentrant at the base of the apertural face of the last-formed chamber. Maximum length 2.00 mm."

Specimens were found in only one sample which was obtained from a shallow test hole drilled in the upper Yazoo clay on a hill ½ mile north of Homewood, Mississippi. Cushman records this species from a locality 1½ miles south of Shubuta.

FAMILY VALVULINIDAE

Genus DOROTHIA Plummer, 1931

DOROTHIA PRINCIPENSIS Cushman and Bermudez

Plate I, 12

Dorothia principensis Cushman and Bermudez, Contr. Cushman Lab. Foram. Res., Vol. 12, pt. 3, p. 57, pl. 10, figs. 3, 4, 1936.

"Test small, elongate, about two and one-half times as long as broad, very slightly compressed, biserial portion making up nearly the entire test, periphery lobulate; chambers distinct except in the earliest portion, of rather uniform size throughout, becoming slightly more inflated toward the apertural end; sutures distinct, depressed, in the biserial portion nearly at right angles to the vertical axis; wall finely arenaceous, smoothly finished; aperture a low, arched opening at the inner margin of the last-formed chamber. Length 0.80 mm.; diameter 0.30 mm."

The figured specimen is the only one obtained from the Scott County samples. It is very similar to the described form, but the line of contact of chambers has a slightly raised irregular ridge of granular shell material.

Test hole J91 in upper Yazoo clay, ½ mile east of Pulaski.

Genus KARRERIELLA Cushman, 1933

KARRERIELLA MAURICENSIS Howe and Ellis

Plate I, 15, 21, 22

Karreriella mauricensis Howe and Ellis, Howe, La. Dept. Cons. Geol. Bull. 14, p. 34, pl. 2, figs. 1, 2, 1939.

"Test elongate, tapering, greatest breadth across the last two chambers, slightly compressed, periphery broadly rounded, earliest chambers indistinct, later biserial with chambers rapidly increasing in size; sutures rather indistinct except in weathered specimens; wall finely arenaceous; aperture elongate, ovate, subterminal, with a distinct lip."

Rare specimens of an elongate tapering form and one test with chambers approximately uniform in width from initial end were found in samples of lower Yazoo clay from two test holes in Scott County. These appear to belong to the species described from the Cook Mountain formation of Louisiana.

Genus LIEBUSELLA Cushman, 1933

LIEBUSELLA BYRAMENSIS (Cushman) var. TURGIDA (Cushman)

Clavulina byramensis Cushman var. *turgida* Cushman, U. S. Geol. Survey Prof. Paper 133, p. 22, pl. 2, figs. 4, 5, 1923; U. S. Geol. Survey Prof. Paper 181, p. 11, pl. 2, fig. 9, 1935.

This form was not found in the Scott County Jackson samples, but it has been reported by Cushman from a location 1½ miles south of Shubuta.

FAMILY MILIOLIDAE

Genus QUINQUELOCULINA d'Orbigny, 1826

QUINQUELOCULINA ANGUINA Terquem

Plate II, 2

Quinqueloculina anguina Terquem, Soc. geol. France Mem., ser. 3, Vol. 1, p. 78, pl. 9 (14), figs. 20a-c, 1878; Vol. 2, p. 180, pl. 19 (27), figs. 20a-c, 1882. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 12, pl. 2, figs. 18, 19, 1935.

"Test about 2½ times as long as broad, compressed, periphery broadly rounded; chambers distinct, inflated, at the base somewhat enlarged and extending well beyond the previous chamber, at the apertural end narrowed and extended into a short cylindrical neck; sutures distinct, much depressed; wall smooth; aperture circular, terminal with a distinct lip and a small, narrow, simple tooth. Length 0.35 mm.; breadth 0.15 mm.; thickness 0.08 mm."

A few small specimens from the lower Yazoo clay and Moodys Branch material of Scott County are referable to this species.

QUINQUELOCULINA BICARINELLA Reuss

Plate II, 3, 4

Quinqueloculina bicarinella Reuss, Akad. Wiss. Wien. sitzber., Vol. 59, p. 456, pl. 1, figs. 6a, b, 1869.

Test small, somewhat flattened, chambers carinate with two irregular ridges developed along periphery; apertural end produced into a short rounded neck.

Specimens which appear to belong to this species came from a sample of lower Yazoo clay from a test hole on the northeast slope of Bald hill, approximately 2½ miles southwest of Lake.

QUINQUELOCULINA LAEVIGATA d'Orbigny

Plate II, 1, 5

Quinqueloculina laevigata d'Orbigny, Annales sci. nat., Vol. 7, p. 301, no. 6, 1826. Terquem, Soc. geol. France Mem., ser. 3, Vol. 2, p. 173, pl. 18 (26), figs. 14, 15, 1882. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 11, pl. 2, figs. 13-15, 1935.

"Test nearly twice as long as broad, slightly compressed, periphery rounded; chambers distinct, somewhat inflated, of nearly uniform diameter, the ends only slightly extended, apertural end slightly exserted; sutures distinct, slightly depressed; wall smooth; aperture nearly circular, terminal, with a simple tooth but usually without a lip. Length 0.35 mm.; breadth 0.20 mm.; thickness 0.12 mm."

Specimens showing considerable variation but still within the limits of this species were identified as belonging to it. These came from several localities out of samples from the basal Yazoo clay to the uppermost bed.

QUINQUELOCULINA LONGIROSTRA d'Orbigny

Plate II, 6, 7

Quinqueloculina longirostra d'Orbigny, Annales sci. nat., Vol. 7, p. 303, no. 46, 1826; Foraminiferes fossiles du bassin tertiare de Vienne, p. 291, pl. 18, figs. 25-27, 1846. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 12, pl. 2, figs. 16a-c, 1935.

"Test nearly twice as long as broad, compressed, periphery subacute; chambers distinct, not inflated, gradually compressed to the subacute, almost keeled periphery, sides on the inner part convex, thence becoming slightly concave toward the periphery, each extending well beyond the previous ones at both ends, apertural end exserted so that the aperture is terminal; sutures distinct, slightly depressed; wall smooth; aperture circular, terminal, with a slight lip and a small, simple tooth. Length 0.90 mm.; breadth 0.45 mm.; thickness 0.25 mm."

Specimens assigned to this species are very angular with a sharp periphery and the faces of the chambers are flat. The apertural end is produced to form an elongate neck. Large specimens are common and range throughout the Jackson formation of Scott County.

QUINQUELOCULINA TESSELLATA Cushman

Plate II, 11, 14

Quinqueloculina tessellata Cushman, U. S. Geol. Survey Prof. Paper 129-F, p. 142, pl. 33, fig. 8; pl. 34, fig. 1, 1922.

"Test elongate, fusiform, in transverse section much angled; periphery rather sharply angled, sides flat and very slightly convex, apertural end very little extended; sutures not very distinct; surface ornamented by longitudinal rows of rather large pits, five or six rows on each side of the largest chamber. Length 1.25 mm.; breadth 0.5 mm."

Three specimens, each slightly different in shape from the others but all pitted in the manner characteristic of the species described from the Marianna limestone, were found in one of the lower Yazoo clay samples from a test hole beside a road fork, 2 miles north of Forkville.

QUINQUELOCULINA sp.

Plate II, 13

This somewhat rugged form is found sparingly in the Yazoo clay. The figured specimen is from a sample of lower Yazoo clay obtained from a test hole on the northeast slope of Bald hill, approximately 2½ miles southwest of Lake.

Genus MASSILINA SCHLUMBERGER, 1893

MASSILINA COOKEI Cushman

Massilina cookei Cushman, U. S. Geol. Survey Prof. Paper 181, p. 13, pl. 3, fig. 17, 1935.

This species is reported to be very common in the Moodys Branch marl at Jackson, the locality from which the holotype came. It was not noted in the Scott County samples.

MASSILINA DECORATA Cushman

Plate I, 26

Massilina decorata Cushman, U. S. Geol. Survey Prof. Paper 129-F, p. 143, pl. 34, fig. 7, 1922; Prof. Paper 133, p. 55, 1923. Cushman and G. D. Hanna, Proc. Calif. Acad. Sci., ser. 4, Vol. 16, p. 224, 1927. Cole and Ponton, Bull. 5, Florida State Geol. Survey, p. 29, pl. 10, fig. 5, 1930. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 20, pl. 2, fig. 6, 1932. Cushman and McMasters, Jour. Pal., Vol. 10, p. 510, pl. 74, fig. 8, 1936. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 13, pl. 3, figs. 14-16, 1935. Cushman, Contrib. Cushman Lab. Foram. Res., Vol. 15, pt. 3, p. 52, pl. 9, fig. 13, 1939.

"Test much flattened, elliptical or oval, slightly longer than broad, basal and apertural ends projecting, the apertural end narrowing to a small cylindrical neck, nearly in the longitudinal axis of the test; sutures rather indistinct; surface dull white; periphery rounded, the wall ornamented by very fine pits, giving a finely granular, matte appearance to the test. Maximum length 1.00 mm."

This little species is common throughout the Jackson formation, and specimens were obtained from most of the Scott County samples.

MASSILINA JACKSONENSIS Cushman

Massilina jacksonensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 2, pl. 1, fig. 4, 1933; U. S. Geol. Survey Prof. Paper 181, p. 13, pl. 3, figs. 7-10, 1935.

This species was described by Cushman from the Jackson formation at Jackson and was reported at Garlands Creek. No specimens were found in the Scott County samples.

MASSILINA JACKSONENSIS Cushman var. PUNCTATOCOSTATA Cushman

Massilina jacksonensis Cushman var. *punctatocostata* Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 3, pl. 1, figs. 5, 6, 1933; U. S. Geol. Survey Prof. Paper 181, p. 14, pl. 3, figs. 11-13, 1935.

This species was not found in any of the Scott County basal Jackson samples, but specimens have been obtained from equivalent beds in Yazoo County. Cushman's holotype is from the Moodys Branch marl at Jackson where the variety is fairly abundant.

MASSILINA MAURICENSIS Howe and Ellis

Plate I, 23, 24

Massilina mauricensis Howe and Ellis, La. Dept. Cons. Geol. Bull. 14, p. 36, pl. 3, figs. 14-16, 1939.

"Test elongate, very much compressed, periphery somewhat flattened; early chambers quinqueloculine, later ones spiroloculine, chambers very elongate with flattened sides; wall smooth; aperture small, rounded with a small simple tooth; apertural end projecting."

The figured specimens came from lower Yazoo clay, test hole J162C, northeast slope of Bald Hill, approximately 2½ miles southwest of Lake.

MASSILINA PRATTI Cushman and Ellisor

Plate I, 25

Massilina pratti Cushman and Ellisor, Contrib. Cush. Lab. Foram. Res., Vol. 7, pt. 3, p. 53, pl. 7, figs. 4a-c, 1931. Howe, La. Dept. Cons. Geol. Bull. 2, p. 21, pl. 2, fig. 5, 1932.

"Test slightly longer than broad, much compressed, periphery distinctly keeled; chambers distinct, projecting at both ends so that the apertural end has a short cylindrical neck, usually six chambers visible on each side in the adult, each chamber inflated in the middle, and compressed toward the sides; sutures distinct, slightly depressed; wall smooth; aperture subcircular with a simple tooth. Length 0.95 mm.; width 0.6 mm."

Samples from three test holes in the upper Yazoo clay in Scott County furnished a few specimens of this species.

Genus SPIROLOCULINA d'Orbigny, 1826

SPIROLOCULINA GRATELOUPI d'Orbigny

Plate II, 12

Spiroloculina grateloupi d'Orbigny, Annales sci. nat., Vol. 7, p. 298, 1826. Terquem, Soc. geol. France Mem., ser. 3, Vol. 1, p. 52, pl. 5, figs. 5, 6, 1878; Vol. 2, p. 155, pl. 16, figs. 6a, b, 1882. Weisner, Archiv Protistenkunde, Vol. 25, p. 203, 1912. Cushman, U. S. Nat. Mus. Bull. 71, pt. 6, p. 31, pl. 4, figs. 4, 5, 1917; U. S. Geol. Survey Prof. Paper 129,

p. 101, pl. 25, fig. 2, 1922; Prof. Paper 133, p. 50, 1923. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 14, pl. 3, figs. 18-21, 1935.

Spiroloculina excavata H. B. Brady (not d'Orbigny), *Challenger* Rept., Zoology, Vol. 9, p. 151, pl. 9, figs. 5, 6, 1884.

"Test with the length greater than the breadth, the periphery flattened or convex, the angles somewhat carinate, flat faces of the test much excavated; wall smooth, matte; apertural end produced with a cylindrical neck. Specimens not exceeding 0.75 mm."

Scott County specimens which resemble those figured by Cushman are sparse in two samples of basal Yazoo clay. The species has been reported from a few other localities in the state.

Genus ARTICULINA d'Orbigny, 1826

ARTICULINA TERQUEMI Cushman

Plate II, 9, 10

Articulina terquemi Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 3, pl. 1, figs. 7a-c, 1933; U. S. Geol. Survey Prof. Paper 181, p. 14, pl. 4, figs. 2, 3, 1935.

The narrow compressed test with rounded periphery and longitudinal costae distinguish this small fossil. A few specimens were found in a sample of Moodys Branch marl from a test hole in Scott County. It is also found in the marl at Jackson.

Genus MILIOLA Lamarck, 1804

MILIOLA JACKSONENSIS Cushman

Miliola jacksonensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 2, pl. 1, figs. 2, 3, 1933. U. S. Geol. Survey Prof. Paper 181, p. 13, pl. 3, figs. 4-6, 1935.

"Test elongate, elliptical or fusiform, large, quinqueloculine; chambers numerous, distinct, the periphery angled; sutures distinct; wall ornamented with numerous oblique, longitudinal costae, with a single row, occasionally a double one, of coarse round pits between each two costae; aperture at the end of a very short neck, cribrate in the adult, in the young with a large number of fine teeth projecting in from the edge. Length 2.00 mm.; diameter 0.55 mm."

The species was found in a test hole sample of Moodys Branch marl in the northwestern part of Scott County, where it is rare; whereas at Jackson, it is common.

MILIOLA SAXORUM Lamarck

Plate II, 8

Miliola (Miliolites) saxorum Lamarck, Annales du Museum, Vol. 5, p. 352, no. 5, 1804; Vol. 9, pl. 17, figs. 2a, b, 1807. Defrance, Dictionnaire des sciences naturelles, Vol. 31, p. 69, 1824; Atlas de conchyliologie, pl. 15, fig. 1. Cushman, U. S. Geol. Survey Prof. Paper 181, pp. 12, 13, pl. 3, figs. 1-3, 1935.

"Test large, elongate, fusiform, quinqueloculine; chambers very numerous, distinct, the periphery flattened; sutures distinct; wall nearly smooth, marked by very numerous small circular pits arranged in oblique rows across the chambers; aperture at the end of a very short neck, cribrate, made up of a large number of pores. Length 2.50 mm.; diameter 0.60 mm."

A few specimens of this species were found in test hole samples from the Moodys Branch member of the Jackson formation in the northwestern part of Scott County. Cushman reports the species from Jackson and Garlands Creek.

Genus TRILOCULINA d'Orbigny, 1826

TRILOCULINA ROTUNDA d'Orbigny var.

Plate II, 18

Triloculina rotunda d'Orbigny, Ann. Sci. Nat., Vol. 7, p. 299, no. 4, 1826. Cushman, U. S. Nat. Mus., Bull. 104, pt. 6, p. 59, pl. 14, figs. 3a-c, 1929. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 23, pl. 2, figs. 4a, b, 1932.

"Test somewhat longer than wide; chambers rotund; periphery broadly rounded; surface of the test made up largely or entirely of the last-formed chambers; sutures very slightly depressed; apertural end somewhat contracted, with a slightly thickened lip; aperture rounded, with a single bifid tooth, projecting somewhat above the outline of the aperture; surface of the test smooth and shining, often with transverse wrinkles. Length 0.53 mm."

Specimens which compare with those described from the Jackson of Louisiana were found sparingly in some samples of basal Yazoo clay and Moodys Branch marl from Scott County.

TRILOCULINA sp.

Plate II, 17

The figured specimen is a bluntly angular form from the lower Yazoo clay of Scott County. It is extremely rare.

Genus PYRGO Defrance, 1924

PYRGO INORNATA (d'Orbigny) var. DANVILLENSIS Howe and Wallace

Plate II, 15, 16

Pyrgo inornata (d'Orbigny) var. *danvillensis* Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 21, pl. 2, figs. 1a, b, 1932.

"Test oviform, completely involute; chambers smooth; sutures slightly depressed; wall smooth, dull white; aperture simple, containing a single broad tooth. Length 0.45 mm.; diameter 0.38 mm."

Specimens that appear to belong to this variety came from a test hole sample in the upper Yazoo clay near the county line, 4 miles southwest of Morton.

FAMILY OPHTHALMIDIIDAE

Genus CORNUSPIRA Schultze, 1854

CORNUSPIRA OLYGOGYRA Hantken

Plate II, 19

Cornuspira olygogyra Hantken, Magy. kir. foldt. int. Evkonyve, Vol. 4, p. 16, pl. 1, fig. 10, 1875 (1876); K. ungar. geol. Anstalt Mitt. Jahrb., Vol. 4, p. 20, pl. 1, fig. 10, 1875 (1881). Cushman, U. S. Geol. Survey Prof. Paper 181, p. 15, pl. 4, fig. 14, 1935. Howe, La. Dept. Cons. Geol. Bull. 14, pp. 39, 40, pl. 3, figs. 9, 10, 1939.

"Test close-coiled, much compressed, sides flattened, periphery truncate; chamber rectangular in section, in end view the apertural end higher than broad, the sides in the last-formed chamber very slightly concave, sutural line distinct and the basal edge of the chamber slightly thickened; wall smooth, glossy. Diameter 0.60 mm."

On most specimens of this form from Scott County the periphery is truncated, but on a few it is rounded, and the test resembles *C. involvens* (Reuss).

This species was common in some of the samples of lower Yazoo clay and Moodys Branch marl of Scott County.

FAMILY LAGENIDAE

Genus ROBULUS Montfort, 1808

ROBULUS ALATO-LIMBATUS (Gumbel)

Plate III, 7

Robulina alato-limbata Gumbel, K. bayer. Akad. Wiss. Munchen, Cl. 2, Abh., Vol. 10, p. 641, pl. 2, figs. 70a, b, 1868 (1870).

Cristellaria alato-limbata Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, no. 9, p. 171, pl. 8, figs. 8a, b, 1926.

Robulus alato-limbatus Cole, Bull. Am. Pal., Vol. 14, no. 51, p. 18, pl. 4, fig. 1, 1927. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 37, pl. 3, figs. 2a, b, 1932. Cushman, U. S. Geol. Survey Prof. Paper 181, pp. 15, 16, pl. 6, figs. 2a, b, 1935. Howe, La. Dept. Cons. Geol. Bull. 14, p. 40, pl. 4, fig. 18, 1939.

"Test close-coiled, last-formed coil composed of few chambers, usually 7 in number, the central region with a large umbo not greatly projecting above the general surface but distinct, periphery with a narrow keel; chambers distinct, not inflated; sutures distinct, not depressed, strongly curved; aperture radiate; wall smooth. Diameter 0.65 mm."

This species is common throughout the Jackson formation in Scott County and is reported by Cushman from a locality 1½ miles south of Shubuta.

ROBULUS ARCUATO-STRIATUS (Hantken) var. CAROLINIANUS Cushman

Plate II, 23

Robulus arcuato-striatus (Hantken) var. *carolinianus* Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 4, pl. 1, figs. 9a, b, 1933; U. S. Geol. Survey Prof. Paper 181, p. 17, pl. 6, figs. 6a, b, 1935.

"Test close-coiled throughout, strongly umbonate, periphery keeled with a fairly wide thin carina; chambers very distinct, 8 or 9 in the last-formed coil, of uniform shape and increasing very slightly in size as added; sutures distinct, strongly limbate, slightly raised, very strongly curved, ending in the middle in a clear umbo; wall smooth except for the slightly raised sutures; aperture slightly protruding, at the peripheral angle, radiate, apertural face slightly concave, the sides thickened. Diameter 1.30 mm."

Specimens assigned to this variety compare favorably in all characteristics except that the Scott County forms have a narrow and somewhat thickened keel. The species was found to be fairly common in the samples of lower Jackson material from that county and is listed by Cushman from a locality 1½ miles south of Shubuta.

ROBULUS ARTICULATUS (Reuss) var. TEXANUS (Cushman and Applin)

Plate III, 6

Cristellaria articulata Reuss var. *texana* Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 170, pl. 8, figs. 1, 2, 1926.

Robulus articulatus (Reuss) var. *texanus* Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 2, fig. 3, 1933.

Lenticulina articulata (Reuss) var. *texana* Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 31, pl. 5, figs. 1, 2, 1932.

Robulus articulatus (Reuss) var. *texanus* (Cushman and Applin), U. S. Geol. Survey Prof. Paper 181, p. 16, pl. 4, figs. 16, 17, 1935.

"This variety is of large size, in the young with the chambers close-coiled, but in the adult with the central portion becoming visible, owing to the shortening of the chambers, which fail to cover the preceding whorl entirely, periphery with a distinct, rounded keel, in the adult with as many as 10 to 12 chambers. Diameter 1.60 mm. or less."

This variety was found to be fairly abundant in samples that range throughout the Jackson formation of Scott County.

ROBULUS CLERICII (Fornasini)

Plate III, 13

Cristellaria clericii Fornasini, Mem. R. Acad. Sci. Bologna, ser. 5, Vol. 9, p. 65, fig. 17, 1901. Nuttall, Quart. Jour. Geol. Soc., Vol. 84, p. 87, pl. 5, fig. 10, 1928.

Robulus clericii (Fornasini) Cushman, Contr. Cushman Lab. Foram. Res., Vol. 5, pt. 4, p. 84, pl. 12, figs. 16, 17, 1929. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 38, pl. 15, fig. 3, 1932.

Rare specimens which appear to belong to this species came from basal Yazoo clay in Scott County.

ROBULUS CULTRATUS Montfort

Plate III, 4

Robulus cultratus Montfort, Conchyliogie systematique, Vol. 1, p. 214, 1808.

Robulina cultrata (Montfort) d'Orbigny, Ann. Sci. Nat., Vol. 7, p. 287, No. 1, Modeles No. 80, 1826; Foram. Foss. Vienne, p. 96, pl. 4, figs. 14, 15, 1846.

Cristellaria cultrata (Montfort) Cushman, U. S. Geol. Surv. Prof. Paper 129, p. 130, pl. 31, fig. 8, 1922.

Robulus cultratus Montfort, Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 38, pl. 7, fig. 1, 1932.

"Test planispiral, entirely involute, equally biconvex, almost circular in outline; periphery with a prominent keel; chambers numerous, about ten in the last formed whorl, not inflated; sutures almost radial, slightly curved, raised and thickened; umbilical area filled with the thickened ends of the sutures which form a pronounced boss; wall calcareous, finely perforate; aperture radial at the periphery but extending a short distance down the concave face of the last-formed chamber as a narrow slit protected on either side by a fine lip. Diameter 0.75 mm."

A number of good specimens, showing the prominent keel, thickened boss, and sutures, came from samples of lower Yazoo clay in test holes 2 miles south of Lake.

ROBULUS DUMBLEI Weinzierl and Applin

Plate II, 20a, 20b

Robulus dumblei Weinzierl and Applin, Jour. Pal., Vol. 3, no. 4, p. 396, pl. 43, figs. 3a, b, 1929.

"The form is close-coiled, strongly biconvex; chambers numerous, ten generally visible in the mature forms; umbo covered by a thick boss of clear shell material; sutures outlined by low ribs which are very narrow near the umbo, and close to the periphery, but widen rapidly in the area between these two points. The margin is outlined by a very thick and narrow keel."

Good specimens of this species, some having the sutures darkened by mineral matter underlying the low ribs, were found in lower Yazoo clay samples from Scott County test holes.

ROBULUS GUTTICOSTATUS (Gumbel)

Robulina gutticostata Gumbel, K. bayer. Akad. Wiss. Munchen, Cl. 2, Abh., vol. 10, p. 643, pl. 1, fig. 74, 1868 (1870). Hantken, Magy. kir. foldt. int. Evkonyve, vol. 4, p. 48, pl. 6, fig. 10, 1875 (1876); K. ungar. geol. Anstalt Mitt. Jahrb., Vol. 4, p. 57, 1875 (1881). Cushman, U. S. Geol. Survey Prof. Paper 181, p. 15, pl. 5, figs. 1, 2, 1935.

"Test close-coiled, periphery acute, keeled, compressed; chambers distinct but not inflated, 9 to 11 chambers in the last-formed coil in the adult; sutures distinct, ornamented, limbate, a raised costa on the exterior broken into a row of rounded, bead-like protuberances, especially toward the umbilicus, the beads increasing in size, with the largest nearest the umbilicus; sutures very slightly curved; wall between the sutures smooth; aperture peripheral, radiate, slightly projecting. Diameter up to 1.50 mm."

Specimens that show stages in variation from the typical species to the variety *cocoaensis* are found throughout the Jackson formation of Scott County.

ROBULUS GUTTICOSTATUS (Gumbel) var. COCOAENSIS (Cushman)

Plate II, 24

Cristellaria gutticostatus (Gumbel) var. *cocoaensis* Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, p. 67, pl. 10, fig. 11, 1925; U. S. Geol. Survey Prof. Paper 181, p. 15, pl. 5, figs. 3, 4, 1935.

"Variety with usually a larger number of chambers in each whorl than in the typical form; sutures with very distinct beading, the beads growing larger toward the inner end of the sutures, and the umbonal region occupied by a series of large bosses, last-formed suture in adults often unornamented and slightly depressed."

Characteristically ornamented specimens, some showing variations in the pattern and amount of beaded protuberances, were common throughout most of the Yazoo clay of Scott county. Immature specimens that resemble the early stages of development of *Marginulina fragaria* (Gumbel) var. *texasensis* (Cushman and Applin) are sometimes found in the same material.

ROBULUS LIMBOSUS (Reuss)

Plate II, 25

Robulina limbosa Reuss, Akad. Wiss. Wien Sitzungsber., Vol. 48, pt. 1, p. 55, pl. 6, figs. 69a, b, 1863 (1864). Hantken, Magy. kir. foldt. int. Evkonyve, Vol. 4, p. 48, pl. 6, fig. 11, 1875 (1876); K. ungar. geol. Anstalt Mitt. Jahrb., Vol. 4, p. 57, pl. 6, fig. 11, 1875 (1881).

Robulus limbosus Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 2, figs. 1a, b, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 16, pl. 6, fig. 5, 1935. Contr. Cushman Lab. Foram. Res., Vol. 15, pt. 3, pl. 9, fig. 20, 1939.

"Test close-coiled, umbonate, periphery with a broad, very thin, plate-like transparent keel; chambers distinct, 9 or 10 in the last-formed coil; sutures distinct, curved, slightly limbate, of clear material, ending at the umbo in a transparent mass of clear shell material; wall smooth; apertural face slightly concave, aperture on the peripheral angle, radiate. Maximum diameter 1.50 mm."

This species was fairly abundant in representative samples that ranged through the Yazoo clay of Scott County. It has been reported from several localities in the Jackson formation of the state.

ROBULUS LIMBOSUS (Reuss) var. HOCKLEYENSIS (Cushman and Applin)

Plate II, 22

Cristellaria limbosa (Reuss) var. *hockleyensis* Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 171, pl. 8, figs. 3, 4, 1926.

Robulus limbosus (Reuss) var. *hockleyensis* Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 1, figs. 11a, b, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 16, pl. 4, figs. 15a, b; pl. 6, figs. 3a, b, 1935. Contr. Cushman Lab. Foram. Res., Vol. 15, pt. 3, pl. 9, fig. 21, 1939.

"Test differing from the typical form in the fewer chambers and the broader form in apertural view, the keel perhaps not so broad and thin, and the central umbo not so strongly developed. Diameter 0.75 mm."

Good specimens were found in samples of Moodys Branch marl and the lower part of the Yazoo clay at several localities in Scott County.

ROBULUS MAYI Cushman and Parker

Plate III, 2

Robulus mayi Cushman and Parker, Contr. Cushman Lab. Foram. Res., Vol. 7, pt. 1, p. 2, pl. 1, figs. 3-5, 1931. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 40, pl. 2, fig. 7, 1932.

"Test comparatively small, much compressed, later chambers tending to elongate but not to definitely uncoil, periphery subacute, slightly keeled; chambers distinct, but not inflated, gradually elongating as added; sutures limbate, very distinct, flush with the surface; wall smooth, very finely perforate; apertural face slightly convex, aperture radiate, at the peripheral angle. Length 0.5 mm."

One sample of Yazoo clay from the top of the formation contained a few specimens that appear to belong to this species. The test hole furnishing the sample was located near the Rankin County line at a point 4 miles southwest of Morton.

ROBULUS PROPINQUUS (Hantken)

Plate II, 21

Cristellaria propinqua Hantken, Magy. kir. foldt. int. Evkonyve, Vol. 4, p. 45, pl. 5, fig. 4, 1875 (1876); K. ungar. geol. Anstalt Mitt. Jahrb., Vol. 4, p. 52, pl. 5, fig. 4, 1876 (1881). Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 172, pl. 8, fig. 9, 1926.

Robulus propinquus Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 7, figs. 12a, b, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 16, pl. 6, figs. 1a, b, 1935. Howe, La. Dept. Cons. Geol. Bull. 14, p. 41, pl. 4, figs. 13, 14, 1939.

"Test with the early portion close-coiled, later tending to become uncoiled, the periphery subacute, later chambers increasing in width; chambers few, 6 or 7 in the last-formed coil, distinct but not inflated; sutures distinct, curved, not depressed; wall smooth; apertural face somewhat tapering toward the aperture, which is radiate and slightly projecting. Diameter 0.60 mm."

Typical specimens and others that show slight variations were found in Yazoo clay samples obtained from test holes in both the lower portion and the uppermost part of the formation in Scott County.

ROBULUS WILCOXENSIS Cushman and Ponton

Plate III, 1, 3

Robulus wilcoxensis Cushman and Ponton, Contr. Cushman Lab. Foram. Res., Vol. 8, pt. 3, p. 52, pl. 7, figs. 3a, b, 1932. Toulmin, Jour. Pal., Vol. 15, p. 579, pl. 78, figs. 24, 25, 1941. Cushman, Contr. Cushman Lab. Foram. Res., Vol. 18, pt. 2, p. 27, pl. 5, fig. 7, 1942.

"Test compressed, close coiled except in the oldest (latest) portion where 1 or 2 chambers may become uncoiled, periphery in the earlier portion with a narrow blunt keel, in the adult chambers with the keel becoming obsolescent and the periphery rounded in the last chambers; chambers numerous, 9 or 10 in the last-formed coil of the adult, later ones slightly inflated and uncoiling, early ones of uniform shape, gradually increasing in size as added; sutures distinct, rather strongly curved, in the early portion limbate and raised, then becoming flush with the surface and in the adult slightly depressed; wall smooth except for the early raised sutures; aperture terminal, radiate in the adult, in the earlier chambers at the outer peripheral angle. Length 1.00-1.15 mm.; breadth 0.75-0.80 mm.; thickness 0.25-0.30 mm."

Certain Jackson specimens appear to be most closely related to the species described from the Wilcox of Alabama. A few show a tendency to uncoil in that the final chamber fails to reach back to the periphery. Upper Yazoo clay samples from Scott County yielded the specimens referred to this species.

Genus LENTICULINA Lamarck, 1804

LENTICULINA CONVERGENS (Bornemann)

Cristellaria convergens Bornemann, Deutsch. geol. Gesell. Zeitschr., Vol. 7, p. 327, pl. 13, figs. 16, 17, 1855.

Lenticulina convergens (Bornemann), Cushman, U. S. Geol. Survey Prof. Paper 181, p. 17, pl. 6, figs. 4a, b, 1935.

"Test compressed, ovate, close-coiled, thickest in the umbonal region but without a distinct umbo; chambers fairly distinct, the later ones increasing somewhat in height; sutures fairly distinct, not depressed; apertural face strongly convex, aperture at the peripheral angle, radiate, slightly produced. Diameter 1.00 mm."

The species ranges through the Jackson formation and was found in several samples from Scott County.

LENTICULINA sp.

Plate III, 5

Test compressed, nearly circular in outline, periphery keeled with a thin carina; chambers fairly distinct, about 6 in last-formed coil; sutures fairly distinct, last one slightly depressed; apertural face somewhat concave; aperture at peripheral angle, radiate.

A somewhat similar form was noted by Howe and Wallace in the Danville Landing beds; but the carina on their specimen does not continue on the last chamber, and the apertural face is convex. The figured specimen is from a test hole in the upper Yazoo clay in the Homewood area, Scott County.

Genus PLANULARIA Defrance, 1824

PLANULARIA CATAHOULAENSIS Howe and Wallace

Plate III, 12

Planularia catahoulaensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 36, pl. 3, figs. 3, 4, 1932.

"Outline subcircular, test compressed, periphery provided with a wide, thin keel; chambers numerous, often twelve or more in adult specimens, younger forms can be found with two or more; sutures distinct, limbate, curvature greatest in the early portion, almost imperceptible in the last few chambers; wall calcareous glossy; aperture, a radiate opening at the peripheral angle. Diameter (adult) 1.35 mm."

Specimens compare favorably with those described from Louisiana. A few show slightly raised boss of shell material in the umbilical region. The species was found very sparingly in the upper Yazoo clay beds of Scott County.

PLANULARIA DANVILLENSIS Howe and Wallace

Plate III, 10

Planularia danvillensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 36, pl. 3, fig. 1, 1932.

"Test planispiral, much compressed, chambers becoming more elongate as added; periphery provided with a thin keel present on the first 8 to 10 visible chambers; chambers numerous, often 12 or more visible from either side; sutures clear, broad, slightly curved; wall calcareous, smooth; aperture located on the angle formed by the periphery and the face of the last-formed chamber, radiate, simple. Length 0.9 mm.; width with keel 0.5 mm."

The species is very rare in the upper Yazoo clay samples of Scott County.

PLANULARIA DANVILLENSIS Howe and Wallace var. YAZOOENSIS Bergquist n. var.

Plate III, 8, 9

Test elongate, biconvex in coiled portion, later much compressed, chambers more elongate as added, large specimens with final chamber considerably removed from early part of test; periphery slightly keeled along coiled part; sutures clear, raised and curved on coiled portion, separated from central boss of shell material; later sutures oblique and flush to slightly depressed; apertural face flattened. Length 0.8 mm. to 1.75 mm., width 0.4 mm. to 0.6 mm.

This variety differs from the typical form in the lack of a thin keel along the early part of the test and in the possession of raised, limbate sutures and a central boss of shell material on the coiled portion.

Specimens obtained were from lower Yazoo clay samples of Scott County.

Holotype: Lower Yazoo clay, test hole J1, Forest; Type slide III, 8, 9, Mississippi Geological Survey.

PLANULARIA OUACHITAENSIS Howe and Wallace var.

Plate III, 11

Planularia ouachitaensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 37, pl. 3, fig. 7a, b, 1932.

"Test elongate, much compressed, slightly trochoid, about twice as long as broad; periphery provided with a thin keel on the close-coiled portion; chambers numerous, 12 or more often visible; sutures limbate, on the close-coiled portion often provided with raised ribs or knobs, on the uncoiled portion flush with the surface or slightly depressed; wall calcareous, finely perforate, aperture located at the peripheral angle, round, radiate. Length 1.5 mm.; width 0.7 mm."

Yazoo clay specimens have the outer periphery provided with a continuous thin keel, which either is paralleled along margins of the uncoiled portion by sharp eneschelon-like ridges along each side or is shifted to one margin and has a secondary keel parallel to it. Length 1.25 mm.; width 0.75 mm. The form was found rarely in samples of the uppermost portion of the Yazoo clay in Scott County.

Type slide III, 11, Mississippi Geological Survey.

Genus MARGINULINA d'Orbigny, 1826

MARGINULINA COCOAENSIS Cushman

Plate IV, 15, 16, 17

Marginulina cocoaensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, p. 67, pl. 10, figs. 9, 10, 1925. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 33, pl. 7, fig. 5, 1932. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, No. 11, pl. 6, fig. 6, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 18, pl. 7, figs. 6, 7, 1935.

"Test elongate, compressed, initial and composed of a few partly coiled chambers much compressed, later and major portion composed of more rounded chambers, 6 to 10 in number in adult specimens; sutures fairly distinct, of clear shell material; ornamentation consisting of 9 or 11 lamellate costae running from the initial end to the base of the last-formed chamber in adults, the last chamber being usually smooth in completely developed specimens, two of the costae forming keels on the compressed portion of the test; aperture at the peripheral side of the apertural face, radiate, at the end of a distinct projection. Maximum length 1.60 mm.; breadth 0.25 mm."

Specimens show various growth stages from short tests, composed of a few chambers, to elongate and somewhat arcuate adult forms. Some specimens are not compressed or coiled in the early portion of the tests and may be megalospheric types.

This species is fairly abundant throughout the Yazoo clay.

MARGINULINA EXIMIA Neugeboren

Plate IV, 8

Marginulina eximia Neugeboren, Verh. Mitt. Siebenburg. Ver. Nat., Jahrb. 2, p. 129, pl. 4, fig. 17, 1851. Cushman, Contr. Cushman Lab. Foram. Res., Vol. 15, pt. 3, p. 56, pl. 9, figs. 27, 28, 1939.

Test smooth, elongate, sigmoid; chambers rapidly increasing in size in uncoiled portion; sutures distinct, oblique in later part; aperture produced and radiate.

A few specimens which appear to belong to this small species were found in Yazoo clay and Moodys Branch marl of Scott County.

MARGINULINA FRAGARIA (Gumbel) var. TEXASENSIS (Cushman and Applin)

Plate IV, 9, 10

Cristellaria fragaria Gumbel var. *texasensis* Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 171, pl. 8, figs. 5-7, 1926.

Lenticulina fragaria (Gumbel) var. *texasensis* Howe and Wallace, La. Dept. Conservation Geol. Bull. 2, p. 32, pl. 5, figs. 3-5, 1932.

Marginulina fragaria (Gumbel) var. *texasensis* Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 2, fig. 4, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 19, pl. 7, figs. 8-10, 1935.

Numerous specimens of this highly ornamented variety show extensive variation in ornamentation and development. In the young the test is somewhat compressed, but the elongate adult specimens are terminated by one or two nearly spherical chambers. Beads of clear shell material exist along the sutures in the compressed portion of the test, and spines or plications cover the surface of later inflated chambers. The species was common throughout the Yazoo clay of the Scott County samples.

MARGINULINA HAVANENSIS Cushman and Bermudez

Plate IV, 11

Marginulina havanensis Cushman and Bermudez, Contr. Cushman Lab. Foram. Res., Vol. 13, pt. 1, p. 9, pl. 1, figs. 31, 32, 1937.

"Test elongate, early portion close coiled, much compressed, later becoming uncoiled and nearly circular in section; chambers distinct, those of the uncoiled portion becoming somewhat inflated, and increasing in height as added; sutures distinct, early ones somewhat limbate, later ones becoming progressively more depressed; wall smooth, very finely perforate; aperture terminal, radiate. Length 1.50-1.75 mm.; diameter 0.40 mm."

A few specimens from the lower Yazoo clay of Scott County appear to be identical with the Cuban species described by Cushman and Bermudez.

MARGINULINA JACKSONENSIS (Cushman and Applin)

Plate IV, 2

Cristellaria jacksonensis Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 172, pl. 8, fig. 10, 1926. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 18, pl. 7, figs. 5a, b, 1935.

"Test much elongate, the greatest width being at the base, where there are a few close-coiled chambers, later portion consisting of 3 to 5 uniserial chambers, much inflated, especially toward the apertural end, early portion with the periphery acute, consisting of 4 or 5 chambers in the coil, the later uncoiled chamber progressively increasing in thickness so that the last-formed chamber is often circular in transverse section; sutures distinct, those of the later portion depressed; wall smooth; aperture radiate, terminal. Maximum length nearly 1.00 mm.; breadth at the base 0.20 mm."

This species was identified in samples from the Moodys Branch material and from the Yazoo clay of Scott County. Specimens show some variation in amount of inflation of later chambers and general shape of test.

MARGINULINA MULTIPLICATA Bergquist, n. sp.

Plate IV, 14a, 14b

Test elongate, sigmoid, composed of 7 or more chambers, early portion curved, compressed, slightly keeled; last two or three chambers inflated, circular in transverse section, comprising over one-half of test; sutures distinct, oblique, depressed on inflated portion; wall ornamented by numerous fine costae, somewhat oblique, confined to individual chambers; aperture radiate, projecting at the periphery, apertures on earlier chambers faintly visible. Length 0.6 mm.

The species is present in the lower Yazoo clay and Moodys Branch marl of Scott County.

Holotype: Lower Yazoo clay, test hole J162C, 2½ miles southwest of Lake; Type slide IV, 14, Mississippi Geological Survey.

MARGINULINA SUBBULLATA Hantken

Plate IV, 4, 5, 6

Marginulina subbullata Hantken, A. magy. kir. foldt. int. evkonyve, Vol. 4, p. 39, pl. 4, figs. 9, 10, 1875 (1876); Mitth. Jahrb. ungar. geol. Anstalt, Vol. 4, p. 46, pl. 4, figs. 9, 10, 1875 (1881). Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, pt. 3, p. 62, pl. 10, figs. 3a, b, 1925. Cushman and G. D. Hanna, Proc. Calif. Acad. Sci., ser. 4, Vol. 16, p. 216, pl. 13, fig. 11, 1927. Cole, Bull. Amer. Pal., Vol. 14, no. 51, p. 14, pl. 5, fig. 10, 1927. Cushman, Contr. Cushman Lab. Foram. Res., Vol. 5, p. 85, pl. 12, fig. 20, 1929. Nuttall, Jour. Pal., Vol. 9, p. 125, pl. 14, fig. 16, 1935. Coryell and Embich, l. c., Vol. 11, p. 297, pl. 42, fig. 2, 1937. Cushman, Contr. Cushman Lab. Foram. Res., Vol. 15, pt. 3, p. 55, pl. 9, figs. 30, 31, 1939.

Adult specimens, composed of 2 to 4 spherical chambers above the partly coiled early portion, were found at a few localities in the Yazoo clay in Scott County.

MARGINULINA SUBLITUUS (Nuttall)

Plate IV, 1, 3

Cristellaria sublituus Nuttall, Jour. Pal., Vol. 6, p. 11, pl. 1, figs. 13-14, 1932.

"Test much compressed with sharp border, which in parts has a very narrow keel. Surface glossy, smooth, sutures narrow, oblique, not depressed. Aperture stellate, terminal. Maximum length 1.1 mm., width 0.1 mm. This species is much more compressed than *Marginulina jacksonensis* (Cushman and Applin), which has been recorded from the Alazan of Mexico. *M. tenuis* Bornemann is also more inflated."

Compressed specimens that check favorably with the species described by Nuttall are found in the Moodys Branch material and throughout the Yazoo clay of Scott County.

MARGINULINA TENUIS Bornemann

Plate IV, 20

Marginulina tenuis Bornemann, Zeitschr. deutsch. geol. Gesell., Vol. 7, p. 326, pl. 13, fig. 14, 1855. Cushman and McGlamery, Contr. Cushman Lab. Foram. Res., Vol. 15, pt. 3, p. 55, pl. 9, figs. 33, 34, 1939.

"Test very elongate, slightly curved, especially in the later half, the earlier portion compressed, later circular in transverse section; chambers of the early portion very oblique and low, overlapping, increasing rapidly in height in the adult, the final ones inflated, longer than the diameter; sutures not much depressed, somewhat indistinct, very oblique in the early portion, nearly transverse in the adult; wall smooth; aperture nearly central, radiate. Length up to 1.25 mm.; diameter of adult 0.18 mm."

A number of specimens in the lower Yazoo clay and in the upper beds belong to this species. Variations in curvature and height of test and amount of inflation are seen in the specimens identified.

MARGINULINA TRIANGULARIS d'Orbigny var. DANVILLENSIS Howe and Wallace

Plate III, 15, 18

Marginulina triangularis d'Orbigny var. *danvillensis* Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 34, pl. 5, figs. 6a, b, 1932.

"Test large, elongate, transverse section generally similar to an isosceles triangle with the angles slightly rounded, early portion close-coiled, later portions uncoiled; chambers fairly numerous, about 8 or more usually visible, only those in the uncoiled portion inflated; periphery rounded; sutures in the coiled portion radial, straight, not depressed, in the uncoiled portion meeting the periphery at an angle of about forty-five degrees, slightly depressed; wall calcareous, smooth; aperture circular, radiate, in some specimens becoming almost central. Width of close-coiled portion 0.25 mm.; length 0.9 mm. or more."

Specimens identified as this variety show considerable variation in the general shape of the tests. All came from the upper beds of the Yazoo clay in Scott County.

MARGINULINA (?) sp.

Plate IV, 7

Test elongate, composed of 5 or 6 chambers; axis of early portion curved; initial chamber bulbous, later chambers elongate, inflated, cylindrical in transverse section; wall smooth, transparent; aperture radiate, projecting at periphery.

A few specimens of this small form were found in a sample of lower Yazoo clay from a test hole at Forest.

Figured specimen, number 7 on type slide IV, Mississippi Geological Survey.

Genus DENTALINA d'Orbigny, 1826

DENTALINA ACUTA d'Orbigny var.

Plate IV, 25

Test slender, arcuate; chambers numerous, increasing in height as added, last one set apart and tapering; sutures distinct but not depressed except on final chamber; wall ornamented by a few strong continuous costae, 4 on young forms and about 8 on adult specimens, terminated at initial end in a short spine; aperture radiate, at end of tapering protuberance.

Figured specimen from test hole J1, Forest. Broken specimens were found sparingly in several of the Yazoo clay samples.

DENTALINA ADOLPHINA d'Orbigny

Plate V, 1

Dentalina adolphina d'Orbigny, Foraminiferes fossiles du bassin tertiaire de Vienne. Gide et Comp., p. 51, pl. 2, figs. 18-20, 1846. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 21, pl. 8, figs. 11, 12, 1935.

Segments and a few nearly complete specimens of an elongate form with short backward projecting spines around the base of each of the inflated chambers were found in several of the Scott County samples, indicating that this form ranges throughout the Jackson.

DENTALINA BASITORTA Cushman

Plate V, 6a, 6b, 15

Dentalina basitorta Cushman, Contr. Cushman Lab. Foram. Res., Vol. 14, pt. 2, p. 37, pl. 6, figs. 4, 5, 1938.

"Test elongate, slender, somewhat curved, initial end with a basal spine, early portion with the chambers somewhat twisted, later uniserial; chambers distinct, the earliest ones elongate, twisted about the elongate axis or even appearing somewhat irregularly biserial, not inflated, later ones strongly inflated, less overlapping; sutures distinct, earlier ones very strongly oblique, not depressed, later ones gradually less oblique and progressively more depressed; wall smooth; aperture terminal, radiate. Length up to 1.00 mm.; diameter 0.18 mm."

Cushman's holotype is from near the top of the Selma chalk 2 miles south of Graham, Mississippi. The Jackson specimens check very closely with the Cretaceous form, the biserial arrangement of the early chambers being clearly visible. Specimens vary in the number of chambers and width of test. Most of the Scott County specimens were found in the lower Yazoo clay, but a few were obtained from the uppermost part of the formation.

DENTALINA cf. CATENULATA Brady

A segment of a few inflated chambers with numerous connecting costae over the depressed sutures was found in a test hole sample of upper Yazoo clay obtained near the Rankin County line, approximately 4 miles southwest of Morton.

DENTALINA COMMUNIS (d'Orbigny)

Plate V, 4

Nodosaria (Dentalina) communis d'Orbigny, Soc. nat. sci. Ann., Vol. 7, p. 254, no. 35, 1826.

Nodosaria communis Cushman, U. S. Nat. Mus. Bull. 104, pt. 4, p. 75, pl. 12, figs. 3, 4, 15-17, 1923.

Dentalina communis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 24, pl. 6, fig. 8, 1932. Toulmin, Jour. Pal., Vol. 15, no. 6, p. 584, pl. 79, fig. 13, 1941.

A few specimens that appear to belong to this species range throughout the Jackson formation in Scott County.

DENTALINA CONSOBRINA d'Orbigny var. EMACIATA Reuss

Dentalina emaciata Reuss, Zeitschr. deutsch. geol. Ges., Vol. 3, p. 63, pl. 3, fig. 9, 1851.

Nodosaria (Dentalina) consobrina var. *emaciata* Reuss, Denkschr. Akad. Wiss. Wien, Vol. 25, p. 132, pl. 2, figs. 12, 13, 1865. (For further references see Cushman, Fla. G. S. Bull. 4, p. 28, 1930).

Dentalina consobrina d'Orbigny var. *emaciata* Reuss, Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 25, pl. 7, fig. 7, 1932.

In samples from two test holes in the upper Yazoo clay of Scott County, a few specimens have been identified as this variety.

DENTALINA COOPERENSIS Cushman

Plate V, 3

Dentalina cooperensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 8, pl. 1, fig. 17, 1933; U. S. Geol. Survey Prof. Paper 181, p. 20, pl. 8, figs. 3, 4, 1935.

"Test elongate, slightly compressed, very slightly tapering, gently curved, periphery only slightly sinuate, apical end pointed or with a single small spine; chambers few, usually about 10 in the adult specimen, often indistinct; sutures fairly distinct, oblique; wall smooth, matte; aperture at the periphery of the chamber slightly projecting. Length 2.00-2.50 mm.; breadth 0.30 mm."

A few specimens obtained from the Scott County samples through the Jackson section compare fairly well with the species described by Cushman, but only rarely was an initial spine observed.

DENTALINA FILIFORMIS (d'Orbigny)

Plate V, 2

"Orthoceratia filiformia aut capillaria" Soldani, Testaceographia, Vol. 2, p. 35, pl. 10, fig. e, 1798.

Nodosaria filiformis d'Orbigny, Ann. Sci. Nat., Vol. 7, no. 14, p. 253, 1826. (For further references to this species see Cushman, U. S. Nat. Mus. Bull. 71, p. 55, 1913).

Dentalina filiformis d'Orbigny, Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 25, pl. 6, figs. 2a, b, 1932.

Segmentary specimens from samples in Scott County indicate that this species ranges throughout the Jackson formation.

DENTALINA HANTKENI Cushman

Dentalina hantkeni Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 9, pl. 1, figs. 18, 19, 1933.

Dentalina budensis Hantken, Magy. kir. foldt. Evkonyve, Vol. 4, p. 28, pl. 3, fig. 12, 1875 (1876). (Not *Nodosaria budensis* Hantken) Cushman, U. S. Geol. Survey Prof. Paper 181, p. 20, pl. 8, figs. 5, 6, 1935.

"Test elongate, arcuate, somewhat compressed, composed of a few chambers, initial end rounded; chambers distinct, increasing in length as added, outer curve sinuate, inner curve nearly uniform; sutures fairly distinct, somewhat oblique; aperture near the inner curve with a slightly produced neck. Length 1.25 mm.; greatest diameter 0.15 mm."

There are a few segments of several chambers each that appear to belong to this species. They came from both upper and lower horizons of the Yazoo clay in Scott County, suggesting that the species may be present sparingly throughout that member of the Jackson formation.

DENTALINA JACKSONENSIS (Cushman and Applin)

Plate V, 13

Nodosaria jacksonensis Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 170, pl. 7, figs. 14-16, 1926. Cushman, Jour. Pal., Vol. 1, p. 153, pl. 24, fig. 3, 1927. Cole, Bull. Am. Pal., Vol. 14, no. 53, p. 208, pl. 3, fig. 12, 1928. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 20, pl. 8, figs. 7-9, 1935.

"Test elongate, tapering, gently curved, initial end rounded, ornamented with one to several spines, sides lobulate throughout, more strongly so in later growth; chambers subglobular, fairly numerous, usually 10 in well-developed specimens, inflated, length and breadth about equal except the last 1 or 2 in the adult, which are slightly longer than broad; sutures distinct, somewhat depressed, of clear shell material, surface smooth, glossy to dull; aperture with a cylindrical neck, the aperture itself not well preserved. Maximum length 2.50 mm.; maximum breadth 0.35 mm."

A few segments of tests, that show the initial portion and that appear to belong to this species, were found in both lower and upper Yazoo clay samples in Scott County.

DENTALINA MEXICANA (Cushman) var. DANVILLENSIS Howe and Wallace

Plate V, 5

Dentalina mexicana (Cushman) var. *danvillensis* Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 26, pl. 6, fig. 4, 1932.

Test elongate, tapering, slightly curved; early chambers subcylindrical, later chambers inflated and rounded; sutures limbate, depressed in later portion of test; aperture eccentric and radiate. Specimens vary in length of test. On some the last chamber is smaller than the one preceding it.

This variety is common in many of the Jackson samples from Scott County.

DENTALINA MULTILINEATA (?) Bornemann

Plate IV, 19

Dentalina multilineata Bornemann, Deutsch. Geol. Ges. Zeitschr., Vol. 7, no. 2, p. 325, pl. 13, fig. 12, 1855.

Segmentary tests of chambers ornamented by numerous fine costae have been provisionally assigned to this species. They were found in lower Yazoo clay samples in Scott County.

DENTALINA NASUTA Cushman

Plate V, 9

Dentalina nasuta Cushman, Contr. Cushman Lab. Foram. Res., Vol. 15, pt. 3, p. 57, pl. 10, figs. 10, 11, 1939.

"Test elongate, slender, slightly curved, gradually tapering from the subacute initial end to the greatest breadth at the last-formed chamber, apertural end produced into a long, tapering cone; chambers distinct, somewhat inflated toward the apertural end, increasing rather rapidly in size and height in the adult portion, slightly overlapping; sutures distinct, depressed in the later portion, somewhat oblique; wall smooth; aperture radiate, at the end of a long, conical, tapering projection of the apertural end of the last-formed chamber. Length up to 1.75 mm.; diameter 0.15-0.25 mm."

Specimens with tapering apertural projections appear to belong to the form described from the east coast. These were noted in the Yazoo clay of Scott County.

DENTALINA SUBSPINOSA (?) Neugeboren

Plate IV, 28

Dentalina subspinosa Neugeboren, K. Akad. Wiss., Math. Naturw. Cl., Denkschr., Wien, Osterreich, Bd. 12, Abth. 2, p. 88, pl. 4, fig. 7a-c, 1856.

A segment of 4 slightly inflated chambers set off by depressed sutures and ornamented by numerous short spines, each projecting toward the initial end of the test, came from a sample of upper Yazoo clay in a test hole approximately 4 miles northeast of Pulaski. This appears to be very similar to the species described from the Miocene of Rumania.

DENTALINA sp. (A)

Plate IV, 18, 27, 29

Test with an initial spine, composed of a few inflated chambers, each ornamented by several low rounded costae which begin at the base or overhang the deeply constricted sutures and diminish toward the apertural end of each chamber; aperture produced, radiate.

Length of broken specimen, (fig. 18) 1.20 mm., width 0.35 mm.; length of three-chambered specimen, (fig. 27) 0.8 mm.

Specimens were found in the Yazoo clay in Scott County.

Type slide IV, 18, 27, 29, Mississippi Geological Survey.

DENTALINA sp. (B)

In one of the Scott County lower Yazoo clay samples there was found an incomplete test of four chambers, each covered by numerous fine oblique costae. It may possibly belong to *D. multilineata* Bornemann.

Genus NODOSARIA Lamarck, 1812

NODOSARIA FISSICOSTATA (Gumbel)

Dentalina fissicostata Gumbel, K. bayer. Akad. Wiss. Munchen, Cl. 2, Abh., Vol. 10, p. 626, pl. 1, fig. 46, 1868 (1870).
Nodosaria fissicostata Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, p. 66, pl. 10, fig. 8, 1925. U. S. Geol. Survey Prof. Paper 181, p. 22, pl. 5, figs. 8, 9, 1935.

Segments of this species were found in lower Yazoo clay samples from Scott County.

NODOSARIA LATEJUGATA Gumbel

Plate IV, 12, 13

Nodosaria latejugata Gumbel, K. bayer Akad. Wiss. Munchen, Cl. 2, Abh., Vol. 10, p. 619, pl. 1, fig. 32, 1868 (1870). Hantken, Magy. kir. foldt. int. evkonyve, Vol. 4, p. 21, pl. 2, figs. 6a-d, 1875 (1876). Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, p. 66, pl. 10, fig. 7, 1925. U. S. Geol. Survey Prof. Paper 181, p. 21, 1935. Cushman and McMasters, Jour. Pal., Vol. 10, p. 512, pl. 75, figs. 11, 12, 1936. Toulmin, Jour. Pal., Vol. 15, no. 6, p. 588, pl. 79, figs. 26, 27, 1941.

"Test elongate, subcylindrical, initial end with a single spine; chambers distinct, slightly inflated; sutures distinct, of clear shell material, slightly depressed; surface ornamented with a few very prominent longitudinal costae, averaging about 10, continuous from initial to apertural ends, except occasionally the final chamber smooth; apertural end slightly prolonged; aperture radiate. Maximum length of American specimens 8.00 mm.; breadth 0.50 mm."

This species is found sparingly in the Moodys Branch material and lower Yazoo clay in Scott County. Complete specimens were rare.

NODOSARIA LATEJUGATA Gumbel var. CAROLINENSIS Cushman

Nodosaria latejugata Gumbel var. *carolinensis* Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 5, pl. 1, fig. 16, 1933; U. S. Geol. Survey Prof. Paper 181, p. 21, pl. 5, figs. 10-13, 1935. Jennings, Bull. Am. Pal., Vol. 23, p. 177, pl. 29, fig. 10, 1936. Toulmin, Jour. Pal., Vol. 15, no. 6, p. 588, pl. 79, fig. 28, 1941.

"Variety differing from the typical form in having the chambers more distinct and more inflated, the costae similar, but double the number in the typical, and the whole test larger."

Segments of two or more inflated chambers with a large number of costae were fairly common in some of the lower Yazoo clay samples from Scott County. These appear to belong to Cushman's variety.

NODOSARIA LONGISCATA d'Orbigny

Plate IV, 26

Nodosaria longiscata d'Orbigny, Foram. Foss. Vienne, p. 32, pl. 1, figs. 10-12, 1826. Plummer, Univ. Tex. Bull. 2644, p. 82, pl. IV, figs. 17a, b, 1926. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 35, pl. 7, fig. 8, 1932. Howe, La. Dept. Cons. Geol. Bull. 14, p. 47, pl. 5, fig. 10, 1939.

Segments of a long cylindrical form appear to compare best with the published data for this species. Several of the test samples from the upper Yazoo clay in Scott County yielded these broken tests.

NODOSARIA PYRULA d'Orbigny var. LONGI-COSTATA (?) Cushman

Plate V, 17

Nodosaria pyrula d'Orbigny var. *longi-costata* Cushman, U. S. Nat. Mus., Vol. 51, no. 2172, p. 653, 1917; U. S. Nat. Mus., Bull. 100, Vol. 4, pl. 33, figs. 8, 9, 1921.

Several longitudinally plicated segments, each a single elongate chamber terminated at each end by a section of a thin connecting neck, are similar to the species figured by Cushman. The costae converge at each end of the chamber but are not paired, for the same plications do not converge at opposite ends. A few segments from a basal Jackson sample are smooth on the middle portion of the chamber, and costae suggest a slight spiral onto connecting neck. Those closest to Cushman's variety came from upper Yazoo clay samples in Scott County.

NODOSARIA RADICULA (Linnaeus)

Plate IV, 21, 22, 23

Nautilus radicula Linnaeus, Syst. Nat. 12 ed. p. 285, 1164, 1767; Gmelin's ed. 13, vol. 1, pt. 6, p. 3373, no. 18, 1788.

Nodosaria radicula Cushman, U. S. Nat. Mus. Bull. 100, Vol. 4, p. 190, pl. 34, fig. 4. Plummer, Univ. Texas Bull. 2644, p. 77, pl. 4, fig. 9, 1926. (Other references listed here).

"Test elongate, stout; chambers few and somewhat overlapping, smooth, short, compact, enlarging very little; sutures transverse, slightly depressed in early part of test but increasingly more constricted toward the oral extremity; shell wall thick, glossy; aperture small, round, protruding, radiate. Length up to 1 mm."

Specimens in the Jackson material exhibit variation in number and shape of chambers. Figured specimens show tests composed of two, four and five chambers. Usually the last-formed is more inflated and larger than the preceding chambers, but some specimens gradually enlarge with the sutures only faintly distinguishable. These were found in both the lower and upper Yazoo clay samples in the Scott County material.

Genus PSEUDOGLANDULINA Cushman, 1929

PSEUDOGLANDULINA LAEVIGATA (d'Orbigny)

Plate IV, 24

Nodosaria (Glandulina) laevigata d'Orbigny, Ann. Sci. Nat., Vol. 7, p. 252, pl. 10, figs. 1-3, 1826.

Pseudoglandulina laevigata (d'Orbigny) Cushman. Contr. Cushman Lab. Foram. Res., Vol. 15, pt. 3, p. 58, pl. 10, figs. 15, 16, 1939.

Specimens which show the features of the genus have been identified as this species. All those noted came from the upper Yazoo clay in Scott County.

Genus SARACENARIA Defrance, 1824

SARACENARIA ARCUATA (d'Orbigny) var. HANTKENI Cushman

Plate III, 16, 17

Cristellaria arcuata Hantken (not d'Orbigny), Magy. kir. foldt. int. Evkonyve, Vol. 4, p. 45, pl. 5, figs. 5a-c, 6, 1875 (1876); K. ungar. geol. Anstalt Mitt. Jahrb., Vol. 4, p. 53, pl. 5, figs. 5a-c, 6, 1875 (1881).

Saracenaria arcuata (d'Orbigny) var. *hantkeni* Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 4, pl. 1, figs. 11, 12, 1933; U. S. Geol. Survey Prof Paper 181, p. 17, pl. 5, figs. 6, 7, 1935.

"Test longer than broad, periphery subacute, apertural face truncate, test triangular in transverse section, early portion somewhat close-coiled in the first few chambers, soon becoming uncoiled; chambers comparatively few, usually only 7 or 8, distinct but not inflated, angles subacute, almost keeled in the last-formed chambers; sutures distinct, very slightly if at all depressed; wall smooth and polished; aperture peripheral, radiate, slightly projecting. Maximum length 1.30 mm.; breadth of final chamber 0.50 mm."

Specimens show considerable variation in curvature and amount of inflation of tests and may represent more than one variety. They appear to range throughout the Jackson beds in Scott County.

SARACENARIA MORESIANA Howe and Wallace

Plate III, 14a, 14b

Saracenaria moresiana Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 42, pl. 2, figs. 8a, b, c, 1932.

"Test elongate, roughly triangular, periphery well rounded, apertural face flaring; chambers few, about six usually visible, each succeeding chamber becoming more elongate and broader; sutures distinct, slightly depressed, slightly curved; wall calcareous, glassy; aperture radiate. Length 0.5 mm."

This common species, specimens of which exhibit little variation from the described and illustrated material, was found in most of the samples from Scott County and ranges throughout the Jackson formation.

Genus VAGINULINA d'Orbigny, 1826

VAGINULINA sp.

Plate V, 16

A few small specimens like the one figured or with the last two chambers somewhat inflated were found in some of the Yazoo clay samples from Scott County.

Genus FRONDICULARIA Defrance, 1826

FRONDICULARIA TENUISSIMA Hantken

Plate V, 14, 25

Frondicularia tenuissima Hantken, K. Ungar. Geol. Anst., Mitt. Jahrb., Vol. 4, no. 1, p. 43, pl. 13, fig. 11a, b, 1875.

Test small, elliptical, flat, apertural end somewhat extended, initial chamber projecting in a stout basal spine; chambers thin, elongate, each extending nearly to base; sutures distinct, limbate, slightly raised; wall smooth; aperture at end of a slight neck.

This species is rare in the lower Yazoo clay of Scott County.

Genus LAGENA Walker and Jacob, 1798

LAGENA ACUTICOSTA Reuss

Plate V, 30

Lagena acuticosta Reuss, Akad. Wiss. Wien Sitzungsber., Vol. 44, pt. 1, p. 305, pl. 1, fig. 4, 1861 (1862). Cushman, U. S. Geol. Survey Prof. Paper 181, p. 23, pl. 9, figs. 5, 6, 1935.

Specimens from samples of both lower and upper Jackson material from Scott County seem to be referable to this somewhat variable species.

LAGENA COSTATA (?) (Williamson)

Plate V, 23

Entosolenia costata Williamson, Recent Foraminifera of Great Britain, p. 9, pl. 1, fig. 18, 1858.

Lagena costata Reuss, Akad. Wiss. Wien Sitzungsber., Vol. 46, pt. 1, p. 329, pl. 4, fig. 54, 1862 (1863). Cushman, U. S. Geol. Survey Prof. Paper 181, p. 23, pl. 9, figs. 7, 8, 1935.

A few specimens from Scott County samples of lower Yazoo clay seem to be referable to this species.

LAGENA GLOBOSA (Montagu)

Plate V, 20

"Serpula (Lagena) laevis globosa" Walker and Boys, Test. Min., p. 3, pl. 1, fig. 8, 1784.

Vermiculum globosum Montagu, Test. Brit., p. 523, 1803.

Lagena globosa (Montagu) Cushman, U. S. Nat. Mus., Bull. 104, pt. 4, p. 20, pl. 4, figs. 1-2, 1923. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 27, pl. 6, figs. 15, 16, 1932.

Subglobose little specimens that appear to belong to this species were found in one lower Yazoo clay sample from Scott County.

LAGENA HEXAGONA (Williamson)

Plate V, 24

Entosolenia squammosa Montagu var. *hexagona* Williamson, Annals and Mag. Nat. Hist., 2d ser., Vol. 1, p. 20, pl. 2, fig. 23, 1848; Recent Foraminifera of Great Britain, p. 13, pl. 1, fig. 31, 1858.

Lagena hexagona (Williamson) Siddall, Catalogue of Rec. Brit. Foram. p. 6, 1879. Cushman, U. S. Geol. Survey Prof. Paper 129, p. 129, pl. 29, fig. 12, 1922. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 28, pl. 6, fig. 14, 1932. Howe, La. Dept. Cons. Geol. Bull. 14, p. 50, pl. 6, fig. 16, 1939.

This tiny distinctive form is found sparingly scattered throughout the Jackson formation.

LAGENA HISPIDA Reuss

Plate V, 31

"Sphaerulae hispidae" Soldani, Testaceographica, Vol. 2, p. 53, pl. 17, figs. 5, 10, 1798.

Lagena hispida Reuss, Zeitschr. deutsch. geol. Ges., Vol. 10, p. 43, 1858. (For other references to this species see: Cushman, U. S. Nat. Mus., Bull. 104, pt. 4, p. 26, pl. 4, figs. 7, 8, 1923). Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 28, pl. 6, fig. 13, 1932.

"Test pyriform, circular in cross section, neck elongate, slender, very gently tapering, unornamented; wall thin, covered with numerous delicate spines uniformly distributed over the surface of the chamber; aperture located at the end of the elongate neck, probably radiate. Length 0.35 mm.; diameter 0.15 mm."

This species was recognized in one sample of lower Yazoo clay and also in a sample of clay from the upper part of the formation in Scott County.

LAGENA HOWEI Bergquist, n. sp.

Plate V, 19

Lagena sp. (C) Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 31, pl. 6, fig. 6, 1932.

Test ampullaceal, smooth, circular in cross section; neck elongate, slender, approximately equal in length to height of chamber, ornamented by two to three spiral costae, each making a complete revolution; aperture circular, surrounded by a phialine lip; rounded base of chamber ornamented with about ten short, radial ridges.

This species is named in honor of Dr. Henry V. Howe of

Louisiana State University. It is found in both the lower and upper Yazoo clay beds of Scott County.

Holotype: Type slide V, 19, Mississippi State Geological Survey.

LAGENA LAEVIS (Montagu) var.

Plate V, 7, 8

"Serpula (Lagena) laevis ovalis" Walker and Boys, Testacaea minuta, p. 3, pl. 1, fig. 9, 1784.

Vermiculum laeve Montagu, Testacea Britannica, p. 524, 1803.

Lagena laevis Williamson, Annals and Mag. Nat. Hist., 2d ser., Vol. 1, p. 12, pl. 1, figs. 1, 2, 1848. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 22, pl. 9, figs. 3, 4, 1935. Howe, La. Dept. Cons. Geol. Bull. 14, p. 50, pl. 6, fig. 12, 1939.

This small relatively smooth form ranges throughout the Jackson formation. Scott County samples yielded a number of specimens.

LAGENA OUACHITAENSIS Howe and Wallace

Plate V, 29

Lagena ouachitaensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 29, pl. 6, fig. 9, 1932.

"Test elongate, pyriform, cross section of chamber circular; surface ornamentation consisting of about twelve costae, six being slightly more prominent and extending up on to the neck, the other six being slightly less prominent and ending at the base of the neck; neck elongate, slender, ornamented with several revolutions of a spiral costa. Length 0.35 mm.; diameter 0.15 mm."

This species is rather common throughout the Jackson formation in Scott County.

LAGENA STRIATA (Montagu) cf. var. INTERRUPTA Williamson

Plate V, 18, 27

Lagena striata (Montagu) var. *interrupta* Williamson, Ann. Mag. Nat. Hist., Vol. 1, ser. 2, p. 14, pl. 1, fig. 7, 1848.

A few specimens which may belong to this variety were found in upper Yazoo clay samples from Scott County. The figures show the variation in shape. The form is comparatively rare.

LAGENA STRIATA (d'Orbigny) var. STRUMOSA Reuss

Lagena strumosa Reuss, Zeitschr. geol. Ges., p. 434, 1858; Sitz. Akad. Wiss. Wien., Vol. 46, pt. 1, p. 328, pl. 4, fig. 49, 1862 (1863).

Lagena striata (d'Orbigny) var. *strumosa* Reuss, Cushman, Contr. Cushman Lab. Foram. Res., Vol. 5, pt. 3, p. 70, pl. 11, figs. 7, 8, 1929. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 30, pl. 6, fig. 11, 1932. Howe, La. Dept. Cons. Geol. Bull. 14, p. 52, pl. 6, fig. 19, 1939.

"Test clavate, body portion subglobular or slightly fusiform, the base with the costae ending in spinose projections; wall with numerous coarse costae; neck elongate, cylindrical with numerous, annular thickenings. Length 0.28 mm."

This species was found rarely in samples of upper Yazoo clay obtained from test holes in Scott County.

LAGENA SUBSTRIATA Williamson

Plate V, 10

Lagena substriata Williamson, Ann. Mag. Nat. Hist., ser. 2, Vol. 1, p. 15, pl. 2, fig. 12, 1848. Cushman, Contr. Cushman Lab. Foram. Res., Vol. 5, pt. 3, p. 68, pl. 11, fig. 4, 1929; Rept. Tenn. Div. Geol. Bull. 41, p. 37, pl. 5, fig. 7, 1931.

The species is characterized by an elongate test with very fine and numerous costae, some continuing onto the neck. A few of the specimens referred to this species from the Jackson formation have spiral costae on the neck and may represent a variety. The specimens came from both lower and upper beds of Yazoo clay in Scott County.

LAGENA SULCATA (Walker and Jacob) var. SEMIINTERUPTA Berry

Plate V, 21, 22

Lagena sulcata (Walker and Jacob) var. *semiinterupta* W. Berry, in Berry and Kelly, Proc. U. S. Nat. Mus., Vol. 76, art. 19, p. 5, pl. 3, fig. 19, 1929. Cushman, Rept. Tenn. Div. Geol. Bull. 41, p. 37, pl. 5, figs. 9-11, 1931.

Jackson specimens that have coalescing costae which form loops either near the basal portion of the test or at the base of the neck are very similar to the form described from the Ripley formation of Tennessee. These came from samples of lower Yazoo clay from Scott County.

LAGENA sp. (A) Howe and Wallace

Lagena sp. (A) Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 30, pl. 6, fig. 12, 1932.

"Test subglobose, only slightly longer than broad, ornamented with about nine remote ribs or costae running from the base to a point slightly below the short neck; costae thin, fairly prominent; wall calcareous, vitreous, thin. Length 0.22 mm.; diameter 0.15 mm."

Some of the specimens from lower Yazoo clay beds of Scott County are sufficiently similar to this unnamed form to be placed with it.

LAGENA sp. (B) Howe and Wallace

Plate V, 26

Lagena sp. (B) Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 30, pl. 6, fig. 10, 1932.

"Test unilocular, shape ampullaceal, circular in cross section; surface ornamentation on the chamber consisting of numerous fine costae, evenly spaced, but extending various distances toward the base of the chamber; wall calcareous, vitreous, very finely perforate; neck elongate, terminal, ornamented with four or more raised rings; aperture circular, at the end of the neck. Length 0.4 mm.; diameter 0.2 mm."

A number of finely costate specimens of this genus are represented in the samples studied from Scott County. They show variations as to the shape of the test and as to the number of costae. A few of them are provisionally placed with the unnamed form described from Louisiana.

LAGENA sp.

Plate V, 28

Test subglobular, covered with numerous fine, discontinuous or branching spiral costae; neck slender, elongate with reticulated spiral ribs. The figured specimen which was the only one obtained is from a sample of uppermost Yazoo clay from a test hole near the Rankin County line, approximately 4 miles southwest of Morton.

FAMILY POLYMORPHINIDAE

Genus GUTTULINA d'Orbigny, 1839

GUTTULINA AUSTRIACA d'Orbigny

Plate VI, 4

Guttulina austriaca d'Orbigny, Foraminiferes fossiles du basin tertiaire de Vienne, p. 223, pl. 12, figs. 23-25, 1846. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 47, pl. 8, fig. 3, 1932. Howe, La. Dept. Cons. Geol. Bull. 14, p. 52, pl. 6, figs. 21, 22, 1939.

Specimens are common throughout the Jackson and are easily distinguishable from *G. irregularis* by the more elongate test and oval inflated chambers, each being farther removed from the base of the test than the succeeding one. Samples from several test holes in Scott County yielded this species.

GUTTULINA IRREGULARIS (d'Orbigny)

Plate VI, 5, 6

Globulina irregularis d'Orbigny, Foraminiferes fossiles du basin tertiaire de Vienne, p. 226, pl. 13, figs. 9, 10, 1846. Cushman and Thomas, Jour. Pal., Vol. 3, p. 177, pl. 23, figs. 2a-c, 1929.

Guttulina irregularis Cushman and Ozawa, U. S. Nat. Mus. Proc., Vol. 77, Art. 6, p. 25, pl. 3, figs. 4, 5; pl. 7, figs. 1, 2, 1930. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 48, pl. 8, fig. 8, 1932. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 24, pl. 9, figs. 13-16, 1935 (and other references). Howe, La. Dept. Cons. Geol. Bull. 14, p. 52, pl. 6, fig. 20, 1939.

This is a common species in the Jackson formation. Samples from several localities in Scott County yielded specimens.

GUTTULINA PROBLEMA d'Orbigny

Plate VI, 1

Guttulina problema d'Orbigny, Annales sci. nat., Vol. 7, no. 14, p. 266, 1826. Cushman and Schenck, California Univ., Bull. Dept. Geol. Sci., Vol. 17, p. 310, pl. 43, figs. 9-11, 1928. Cushman and Ozawa, U. S. Nat. Mus. Proc., Vol. 77, art. 6, p. 19, pl. 2, figs. 1-6; pl. 3, figs. 1a-c, 1930. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 49, pl. 7, fig. 9, 1932. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 23, pl. 9, fig. 12, 1935 (and other references). Toulmin, Jour. Pal., Vol. 15, no. 6, p. 594, pl. 80, fig. 8, 1941.

Jackson samples from Scott County furnished a few specimens which belong to this species. A few like the figured specimen are unusually large.

GUTTULINA SPICAEFORMIS (Roemer)

Polymorphina spicaeformis Roemer, Neues Jahrb., pl. 3, p. 386, fig. 31, 1838.
Guttulina spicaeformis Cushman and Ozawa, U. S. Nat. Mus. Proc., Vol. 77, art. 6, p. 31, pl. 5, figs. 1, 2, 1930. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 7, fig. 3, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 24, pl. 9, fig. 17; pl. 10, figs. 9, 10, 1935.

This species was reported by Cushman from several localities in Mississippi but was not identified in the Scott County Jackson material.

GUTTULINA sp.

Plate VI, 11

Test elongate, fusiform, greatest breadth about the middle, initial end rounded; chambers numerous, inflated, elongate, last-formed nearly one-half length of test; sutures distinct, slightly depressed in later part; wall smooth, polished; aperture radiate, terminal.

A single specimen was found in upper Yazoo clay from a test hole (J226A) on a hill (near center of east edge Sec. 32, T.6 N., R.7 E.) approximately one mile east of the Morton and Pulaski road.

Genus GLOBULINA d'Orbigny, 1839

GLOBULINA AMPULLA (Jones)

Plate VI, 10

A few small specimens which appear to resemble most closely this species came from test hole J40 (NE. 1/4, SW. 1/4, NW. 1/4, Sec. 12, T.5 N., R.6 E.) 1/2 mile northwest of the Stage road junction.

GLOBULINA GIBBA d'Orbigny

Plate VI, 8, 9

Globulina gibba d'Orbigny, Annales sci. nat., Vol. 7, p. 266, no. 10, Modeles, no. 63, 1826; Foraminiferes fossiles du bassin tertiaire de Vienne, p. 227, pl. 13, figs. 13, 14, 1846. Terquem, Essai sur le classement des animaux de Dunkerque, p. 38, pl. 5, fig. 15, 1875; Soc. geol. France Mem., ser. 3, Vol. 1, p. 43, pl. 4 (9), figs. 1-5, 1878; Vol. 2, p. 130, pl. 13 (21), figs. 22-27, 1882. Jones and Chapman, Linnean Soc. London Jour., Zoology, Vol. 25, pp. 509, 515, figs. 6, 7, 40 (in text), 1896. Cushman and Ozawa, U. S. Nat. Mus. Proc., Vol. 77, art. 6, p. 60, pl. 16, figs. 1-4, 1930. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 46, pl. 8, figs. 11a, b, 1932. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 25, pl. 9, fig. 18, 1935 (and other references). Howe, La. Dept. Cons. Geol. Bull. 14, p. 53, pl. 6, figs. 25, 26, 1939. Toulmin, Jour. Pal., Vol. 15, no. 6, p. 594, pl. 80, fig. 9, 1941.

This is a very common species in the Jackson of Mississippi and is present in many of the Scott County samples.

GLOBULINA GIBBA d'Orbigny var. GLOBOSA (Von Munster)

Plate VI, 12

Polymorphina globosa Von Munster, in Roemer, Neues Jahrb., 1838, p. 386, pl. 3, fig. 33. Reuss, Versteinerungen der bohmischen Kreideformation, p. 40, pl. 13, fig. 82, 1845. Egger, K. bayer. Akad. Wiss. Munchen, Cl. 2, Abh., Vol. 21, pt. 1, p. 129, pl. 17, fig. 26, 1899.

Globulina gibba d'Orbigny var. *globosa* Cushman and Ozawa, U. S. Nat. Mus. Proc., Vol. 77, art. 6, p. 64, pl. 17, figs. 8, 9, 1930. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 46, pl. 8, fig. 10, 1932. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 26, pl. 9, fig. 21, 1935 (and other references).

A few specimens identified as this variety were found in samples of the lower Yazoo clay of Scott County.

GLOBULINA GIBBA d'Orbigny var. TUBERCULATA d'Orbigny

Plate VI, 13, 18

Globulina tuberculata d'Orbigny, Foraminiferes fossiles du bassin tertiaire de Vienne, p. 230, pl. 13, figs. 21, 22, 1846. Terquem, Soc. geol. France Mem., ser. 3, Vol. 2, p. 132, pl. 13 (21), figs. 33, 34, 1882.

Globulina gibba d'Orbigny var. *tuberculata* Cushman and Ozawa, U. S. Nat. Mus. Proc., Vol. 77, art. 6, p. 68, pl. 17, figs. 6, 7, 1930. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 26, pl. 9, figs. 19, 20, 1935 (and other references).

Several lower Jackson samples from Scott County yielded specimens of this spinosa variety, some with fistulose tubes as shown by the figured specimen.

GLOBULINA INAEQUALIS Reuss

Globulina inaequalis Reuss, K. Akad. Wiss. Wien Denkschr., Vol. 1, p. 377, pl. 48, fig. 9, 1850. Cushman and Ozawa, U. S. Nat. Mus. Proc., Vol. 77, art. 6, p. 73, pl. 18, figs. 2-4, 1930. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 26, pl. 9, fig. 22, 1935.

There are a few specimens in the collection of foraminifera obtained from lower Yazoo clay Scott County samples that are somewhat compressed and appear to be most like this form. It has been found rarely in the Eocene sediments of the Gulf Coastal Plain.

GLOBULINA MINUTA (Roemer)

Plate VI, 7

Polymorphina minuta Roemer, Neues Jahrb., 1838, p. 386, pl. 3, fig. 35. Reuss, Akad. Wiss. Wien Sitzungsber., Vol. 62, pt. 1, p. 486, 1870. Von Schlicht, Die Foraminiferen des Septarienthones von Pietzpuhl, pl. 27, figs. 13-15; pl. 25, figs. 51-56, 1870. Bornemann, Deutsch. geol. Gesell. Zeitschr., Vol. 7, p. 344, pl. 17, fig. 3, 1855.

Globulina minuta Cushman and Ozawa, U. S. Nat. Mus. Proc., Vol. 77, art. 6, p. 83, pl. 20, figs. 3, 4, 1930. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 27, pl. 9, fig. 23, 1935 (and other references).

This small species, which is pointed at both ends of the test and circular to elliptical in section, was found in a few samples of lower Jackson in Scott County.

GLOBULINA ROTUNDATA (Bornemann)

Guttulina rotundata Bornemann, Zeitschr. deutsch. geol. Gesell., Vol. 7, p. 346, pl. 18, fig. 3, 1855.

Globulina rotundata Cushman, U. S. Nat. Mus. Proc., Vol. 77, art. 6, p. 86-88, pl. 21, figs. 3, 4, 1930. Howe, La. Dept. Cons. Geol. Bull. 2, p. 47, pl. 15, fig. 4, 1932.

A single specimen that seems to be related most closely to this species came from a sample of uppermost Yazoo clay obtained from a test hole near the Rankin County line, approximately 4 miles southwest of Morton.

Genus SIGMOMORPHINA Cushman and Ozawa, 1928

SIGMOMORPHINA JACKSONENSIS (Cushman)

Polymorphina jacksonensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 2, p. 36, pl. 5, figs. 5a, b, 1926.

Sigmomorphina jacksonensis Cushman and Ozawa, U. S. Nat. Mus. Proc., Vol. 77, art. 6, p. 123, pl. 32, figs. 2a, b, 1930. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 49, pl. 8, fig. 2, 1932.

Polymorphina compressa Nuttall (not d'Orbigny), Geol. Soc. London Quart. Jour., Vol. 84, p. 93, pl. 6, figs. 18, 19, 1928. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 28, pl. 10, figs. 1-4, 1935.

"Test broad and compressed, periphery broadly rounded, apertural end narrowed to a slightly produced aperture; chambers elongate, slightly inflated, embracing, arranged in a contra-clockwise sigmoid series, each succeeding chamber removed farther from the base; sutures very slightly depressed, distinct, almost straight; wall thick, smooth; aperture radiate. Maximum length 1.10 mm.; breadth 0.65 mm.; thickness 0.25 mm."

This species was found in several samples of lower Yazoo clay and also in the Moodys Branch marl obtained from test holes drilled in Scott County.

SIGMOMORPHINA JACKSONENSIS (Cushman) var. COSTIFERA Cushman and Ozawa

Plate VI, 2, 3

Polymorphina jacksonensis Cushman var. *costifera* Cushman, Contr. Cushman Lab. Foram. Res., Vol. 2, p. 35, 1926.

Sigmomorphina jacksonensis (Cushman) var. *costifera* Cushman and Ozawa, U. S. Nat. Mus. Proc., Vol. 77, art. 6, p. 123, pl. 32, figs. 3a, b, 1930. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 7, fig. 1, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 28, pl. 10, figs. 5, 6, 1935. Howe, La. Dept. Cons. Geol. Bull. 14, p. 54, pl. 7, fig. 1, 1939.

"Variety differing from the typical form in the ornamentation of the test, which has several rounded longitudinal costae on the basal portion, sometimes covering a large part of the surface. Maximum length 1.20 mm.; breadth 0.50 mm.; thickness 0.13 mm."

Excellent large specimens of this variety, some associated with the typical form, were found in a number of lower Jackson samples. The amount of ornamentation developed on individuals shows some variation. Though found in samples of both the Moodys Branch marl and the lower Yazoo clay, the best specimens came from the latter material in Scott County.

Genus POLYMORPHINA d'Orbigny, 1826

POLYMORPHINA ADVENA Cushman

Plate VI, 14, 15

Polymorphina advena Cushman, U. S. Geol. Survey Prof. Paper 129, p. 132, pl. 31, fig. 4, 1922; Contr. Cushman Lab. Foram. Res., Vol. 5, p. 41, pl. 7, fig. 5, 1929. Cushman and Ozawa, U. S. Nat. Mus. Proc., Vol. 77, art. 6, p. 118, pl. 30, figs. 10a, b, 1930. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 29, pl. 10, fig. 8, 1935. Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189-D, p. 106, pl. 24, fig. 21, 1937.

"Test much compressed, broadly ovate; chambers numerous, elongate, alternating, much the broadest near the apertural end; sutures slightly depressed, very oblique; surface ornamented with numerous fine longitudinal costae, often obscure, except the last-formed one or two chambers, which are smooth, at least at the apertural end; aperture radiate. Length 0.40-0.65 mm.; breadth 0.22-0.30 mm.; thickness 0.05-0.06 mm."

A few specimens from lower Yazoo clay samples from Scott County resemble this form closely. The species was not noted in the upper beds, although Cushman reported it from the Moodys Branch marl at Jackson.

POLYMORPHINA FRONDEA (Cushman) var. ?

Plate VI, 16, 17

Bolivina frondea Cushman, U. S. Geol. Survey Prof. Paper 129-F, p. 126, pl. 29, fig. 3, 1922; Prof. Paper 133, p. 20, 1923.

Polymorphina frondea Cushman, Contr. Cushman Lab. Foram. Res., Vol. 5, p. 41, 1929. Cushman and Ozawa, U. S. Nat. Mus. Proc., Vol. 77, art. 6, p. 118, pl. 30, figs. 11a, b, 1930.

"Test compressed, of uniform thickness, the broad sides nearly parallel, oblong, broadest above the middle, acuminate toward the initial end, margins with a raised rim; chambers compressed, elongated, alternating; sutures depressed, distinct; wall smooth, often with obscure fine costae; aperture radiate. Length 0.50-0.65 mm.; breadth 0.30-0.40 mm.; thickness 0.04-0.05 mm."

The Jackson specimens may be a variety of this species, for the later chambers are elongate and terminate in the initial third of the test. A slight concavity is produced in the early portion of the test by the later chambers rising somewhat above this part. All the specimens obtained came from lower Yazoo clay beds in Scott County.

Genus RAMULINA Rupert Jones, 1875

RAMULINA GLOBULIFERA H. B. Brady

Plate VI, 21

Ramulina globulifera H. B. Brady, Quart. Jour., Micr. Sci., Vol. 19, p. 272, pl. 8, figs. 32, 33, 1879. White, Jour. Pal., Vol. 2, p. 214, pl. 29, fig. 2, 1928. Plummer, Univ. Texas Bull. 3101, p. 174, pl. 11, fig. 15, 1931. Toulmin, Jour. Pal., Vol. 15, no. 6, p. 596, pl. 80, fig. 21, 1941.

"Test free, branching, composed of segments of different sizes connected by stoloniferous tubes. Segments numerous (two to eight or more), globular or subglobular, each with several (two to six) tubulated apertures extended from different portions of the periphery, some of which terminate in fresh chambers. Stoloniferous tubes narrow, circular in section, about equal in length to the diameter of the larger chambers. Texture hyaline; surface hispid or aculeate. Length, when complete, 1/15 inch (1.7 millim.) or more."

A few segmentary specimens composed of inflated hispid chambers with 5 to 7 stolen tubes are identified as this species. It appears to range sparingly throughout the Jackson.

FAMILY NONIONIDAE

Genus NONION Montfort, 1808

NONION ADVENUM (Cushman)

Plate VI, 20

Nonionina advena Cushman, U. S. Geol. Survey Prof. Paper 129, p. 139, pl. 32, fig. 8, 1922; Prof. Paper 133, p. 50, 1923. Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 181, pl. 10, figs. 16, 17, 1926. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 30, pl. 11, figs. 1-4, 1935; Prof. Paper 191, p. 9, pl. 20, figs. 3, 4, 1939.

This species was recognized in Scott County in one basal Jackson sample, and it is listed by Cushman as present in the formation at Jackson and at Garlands Creek.

NONION APPLINI Howe and Wallace

Plate VI, 19

Nonionina scapha (Fichtel and Moll) var. Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 182, pl. 10, figs. 12, 13, 1926.

Nonion applini Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 51, pl. 9. figs. 4a, b, 1932. Cushman, U. S. Geol. Survey Prof. Paper 191, p. 8, pl. 2, fig. 7, 1939.

"Test compressed, sides almost parallel, planispiral, involute; periphery almost circular in outline, slightly rounded; chambers slightly inflated, about eight or nine in the last-formed coil; umbilical area slightly depressed; sutures radial, almost straight, distinct, depressed; wall finely perforate, calcareous, thin, umbilicus filled with calcareous beads; aperture a curved slit at the base of the last-formed chamber, protected by a faint lip. Diameter 0.45 mm.; thickness 0.2 mm."

This is a very common species in the Scott County samples, ranging throughout the Jackson formation. On many of the specimens the beaded area of the umbilicus was obscured by a filling of foreign material.

NONION CHAPAPOTENSE Cole

Nonion chapapotensis Cole, Bull. Am. Paleontology, Vol. 14, no. 53, p. 210 (10), pl. 1, figs. 18, 19, 1928. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 30, pl. 11, figs 9-13, 1935; Prof. Paper 191, p. 6, pl. 2, figs. 1-3, 1939.

This species was not recognized in the Scott County samples of the Jackson formation, but Cushman reports it from the formation at Yazoo City.

NONION DANVILLENSIS Howe and Wallace

Plate VI, 25

Nonion danvillensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 51, pl. 9, fig. 3, 1932. Cushman, U. S. Geol. Survey Prof. Paper 191, p. 5, pl. 1, fig. 19, 1939.

"Test much compressed, planispiral, sides almost parallel, slightly involute, slightly elongate; periphery rounded, distinctly lobate; chambers fairly numerous, about seven in the last-formed whorl, inflated; sutures distinct, radial, slightly curved, depressed; wall calcareous, thin, finely perforate; aperture a curved slit at the base of the last-formed chamber, bordered by a faint lip. Diameter 0.27 mm.; thickness 0.1 mm."

This species was very abundant in samples from several localities in Scott County and ranges through the entire Jackson formation. It is related to *N. micrum* Cole which has fewer chambers showing in the last-formed whorl. The latter has been reported by Cushman from the formation at Hays Chapel, Wayne County.

NONION INEXCAVATUM (Cushman and Applin)

Nonionina advena Cushman var. *inexcavata* Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 182, pl. 10, figs. 18, 19, 1926.

Nonion inexcavatum Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 2, fig. 7, 1933.

Nonion inexcavatum (Cushman and Applin) var. Ellisor, op. cit., pl. 7, figs. 10a, b; Cushman, U. S. Geol. Survey Prof. Paper 181, p. 30, pl. 11, figs. 5-8, 1935, Prof. Paper 191, p. 7, pl. 2, fig. 4, 1939.

Cushman lists this species from the Moodys Branch member of the Jackson at Jackson, but it was not identified in any of the Scott County samples.

NONION PLANATUM Cushman and Thomas

Plate VI, 24

Nonion planatum Cushman and Thomas, Jour. Pal., Vol. 4, p. 37, pl. 3, figs. 5a, b, 1930. Cushman and Dusenbury, Contr. Cushman Lab. Foram. Res., Vol. 10, p. 60, pl. 8, figs. 6a, b, 1934. Howe, La. Dept. Cons. Geol. Bull. 14, p. 68, pl. 7, figs. 24, 25, 1939. Cushman, U. S. Geol. Survey Prof. Paper 191, p. 4, pl. 1, fig. 15, 1939.

"Test planispiral, close-coiled, compressed, bilaterally symmetrical, biumbilicate, periphery rounded; chambers distinct, but not inflated, about 10 in the last-formed coil, which is almost completely involute, peripheral face of the last chamber convex; sutures distinct, earlier ones flush with the surface, later ones very slightly depressed, ending in a thickened ring about the umbilici; wall smooth, finely perforate; aperture a crescent-like slit at the base of the last-formed chamber. Maximum diameter, 0.25 mm.; minimum diameter, 0.22 mm.; thickness, 0.11 mm."

A number of specimens of this species came from samples from the Moodys Branch marl and lower Yazoo clay of Scott County. Many of the specimens showed the features of the species clearly.

Genus NONIONELLA Cushman, 1926

NONIONELLA HANTKENI (Cushman and Applin) var. SPISSA Cushman

Plate VI, 22

Nonionella hantkeni (Cushman and Applin) var. *spissa* Cushman, Contr. Cushman Lab. Foram. Res., Vol. 7, p. 58, pl. 7, figs. 13a-c, 1931. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 2, figs. 10, 12, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 31, pl. 12, figs. 6a-c, 1935; Prof. Paper 191, p. 30, pl. 8, fig. 5, 1939.

"Variety differing from the typical form in the much thicker test, usually smaller number of chambers, and less limbate sutures."

Specimens that compare with this variety were in several samples of Moodys Branch marl and lower Yazoo clay from Scott County. Its presence at Garlands Creek and Jackson has been reported by Cushman.

NONIONELLA JACKSONENSIS Cushman

Plate VI, 23

Nonionella jacksonensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 10, pl. 1, figs. 23a-c, 1933; U. S. Geol. Survey Prof. Paper 181, p. 31, pl. 12, figs. 3, 4, 1935; Prof. Paper 191, p. 29, pl. 8, fig. 2, 1939.

"Test longer than broad, periphery rounded, ventral side involute and the chambers extending over the umbilical region, dorsal side with the chambers ending at the umbilical region; chambers distinct, about 8 in the final whorl, becoming increasingly elongate in the adult, the inner end of the final chamber extending across the umbilical area nearly to the periphery on the ventral side, inflated; sutures distinct, slightly if at all depressed; wall smooth, finely perforate; aperture peripheral at the base of the apertural face, low. Length 0.35 mm.; breadth 0.20 mm.; thickness 0.10 mm."

This species was obtained from several samples through the Jackson section in Scott County. It does not appear to be very abundant.

FAMILY CAMERINIDAE

Genus OPERCULINA d'Orbigny, 1826

OPERCULINA COOKEI Cushman

Operculina cookei Cushman, U. S. Geol. Survey Prof. Paper 128, p. 127, pl. 18, figs. 1, 2, 1921; U. S. Geol. Survey Prof. Paper 181, p. 32, 1935.

This large species was not seen in any of the test hole samples from Scott County, but it is reported by Cushman from the Moodys Branch member of the Jackson at Jackson.

FAMILY HETEROHELICIDAE

Genus GUMBELINA Egger, 1899

GUMBELINA CUBENSIS Palmer

Plate VI, 26, 27

Gumbelina cubensis Palmer, Soc. Cubana Hist. Nat., Mem., Vol. 8, no. 2, p. 74, figs. 1-6, 1934.

"Test minute. Comprising approximately 7 pairs of chambers biserially arranged throughout. Chambers inflated; increasing regularly but rapidly in width so that the last 2 pairs form half the length of the test. Maximum width at apertural extremity. Sutures depressed. In side view periphery only moderately lobulate. Aperture a very low opening at the base of the final chamber. Wall calcareous, very finely perforated, slightly roughened.

"Dimensions: Length approximately .25 mm. There is considerable variation in the width. Average specimens have a width of .15 mm., but specimens .1 mm. in width are not uncommon."

Small tests that are identified as this species, which was described from the Oligocene of Cuba, are found in the finer screenings of several of the samples from the entire Jackson section in Scott County.

GUMBELINA CUBENSIS Palmer var. HETEROSTOMA Bermudez

Gumbelina cubensis Palmer var. *heterostoma* Bermudez, Soc. cubana Hist. Nat., Mem., Vol. 11, p. 143, pl. 17, figs. 5-7, 1937.

This variety differs from the species proper in having an eccentric aperture with a thin collar. Its length is approximately 0.25 mm. Specimens from the upper Yazoo clay of Scott County show the apertural feature of this variety.

Genus PLECTOFRONDICULARIA Liebus, 1903

PLECTOFRONDICULARIA MEXICANA (Cushman)

Plate VI, 28

Frondicularia mexicana Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, pt. 4, p. 88, pl. 13, fig. 5, 1926.

"Test somewhat compressed, very elongate, narrow, the peripheral portion with 3 sharp, plate-like carinae, one in the middle line, the other two lateral; the sides except for the initial end parallel, initial end rounded, slightly tapering, the early portion of the test convex, ornamented by a few longitudinal raised costae, the later portion concave, smooth; chambers rather indistinct; sutures hardly if at all depressed, aperture terminal, central, radiate. Length up to nearly 1 mm."

A single specimen of this species was found in a sample of upper Yazoo clay from a test hole near the Rankin County line, approximately 4 miles southwest of Morton.

Genus AMPHIMORPHINA Neugeboren, 1850

AMPHIMORPHINA YAZOOENSIS Bergquist, n. sp.

Plate VII, 26

Test elongate, sides nearly parallel, earliest portion biserial and somewhat compressed with periphery keeled, later uniserial; chambers distinct, last two or three inflated, much higher than preceding, rounded in transverse section; sutures distinct, limbate, arched on early uniserial portion, later depressed and transverse; walls ornamented by a few high longitudinal costae, continuous over length of test, on later chambers increasing in number by implantation; aperture dendritic with irregular ridges penetrating from margin. Length 1.75 mm.; maximum width 0.17 mm.

This form somewhat resembles *A. lirata* Cushman and Bermudez described from the upper Eocene of Cuba.

Holotype: Lower Yazoo clay, test hole J1A, Forest; Type slide VII, 26, Mississippi Geological Survey.

FAMILY BULIMINIDAE

Genus BULIMINELLA Cushman, 1911

BULIMINELLA BASISTRIATA Cushman and Jarvis var. NUDA Howe and Wallace

Plate VII, 7

Buliminella basistriata Cushman and Jarvis var. *nuda* Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 60, pl. 11, fig. 4, 1932.

"Test small, tapering, with the greatest width usually toward the apertural end, 3 to 5 chambers in a coil, fairly distinct, very slightly inflated; sutures distinct, slightly depressed; wall smooth; aperture comparatively large, broadest toward the inner end, slightly oblique. Length 0.38 mm. This variety differs from the typical species in its lack of ornamentation on the initial end."

As they exhibit marked expansion of the tests early in the development, some specimens vary from the form figured from Louisiana.

Specimens assigned to this variety are found sparingly in samples throughout the Jackson of Scott County.

BULIMINELLA cf. BASSENDORFENSIS Cushman and Parker

Plate VII, 9

Buliminella bassendorfensis Cushman and Parker, Contr. Cushman Lab. Foram. Res., Vol. 13, pt. 1, p. 40, pl. 4, figs. 13a, b, 1937.

A few specimens from the lower Yazoo clay samples from Scott County resemble most closely the species described from the Bassendorf shale of the Oligocene of Oregon.

BULIMINELLA ELEGANTISSIMA (d'Orbigny)

Bulimina elegantissima d'Orbigny, Voy. Amer. Merid., Vol. 5, No. 5, "Foraminiferes," p. 51, pl. 7, figs. 13, 14, 1839.

Buliminella elegantissima Cushman, U. S. Nat. Mus., Bull. 71, pt. 2, p. 89, 1911; Fla. Geol. Surv. Bull. 4, p. 42, pl. 8, figs. 2, 3, 1930. (For other references to this species see this reference). Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 61, pl. 11, fig. 3, 1932.

"Test elongate, spiral, making about three volutions, initial end pointed, much more so in the microspheric form; chambers numerous, seven to ten in the last-formed whorl, narrow, slightly inflated; sutures distinct, slightly curved, very slightly depressed; wall smooth, finely perforate; aperture elongate, narrow, somewhat enlarged toward the middle of the apertural face. Length 0.3 mm.; diameter 0.1 mm."

A few tiny specimens that belong to this species came from a sample of upper Yazoo clay about 4 miles southwest of Morton.

BULIMINELLA sp.

Plate VII, 1, 2, 3, 4, 5, 6

Test spiral, much elongate, composed of 5 or more whorls, early portion tapering, greatest width about middle or near apertural end, periphery lobulate; chambers numerous, inflated, 3 or 4 comprising a coil; sutures distinct, depressed; wall smooth; aperture comparatively large and broad. Length 0.5 mm.; maximum width 0.17 mm.

Specimens show some variation and bear resemblance to *B. bassendorfensis* Cushman and Parker, but the aperture is larger and occupies most of the apertural face. The species was found sparingly throughout the Yazoo clay of Scott County.

Genus ROBERTINA d'Orbigny, 1846

ROBERTINA SUBTERES (H. B. Brady) var. ANGUSTA (Cushman)

Plate VII, 8

Buliminella subteres H. B. Brady var. *angusta* Cushman, U. S. Geol. Survey Prof. Paper 129-F, p. 127, pl. 29, figs. 8, 9, 1922.

"Variety differing from the typical species in the more elongate, narrower shape of the test and the larger number of chambers; aperture elongate, nearly in the long axis of the test; sutures not depressed, marked by darker lines of shell material. Length 0.6 mm."

Specimens that appear to compare favorably with this variety were found in samples of basal Yazoo clay obtained from three test holes located respectively in the eastern, central, and western portions of the Jackson belt of Scott County.

Genus BULIMINA d'Orbigny, 1826

BULIMINA JACKSONENSIS Cushman

Bulimina jacksonensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, pt. 1, p. 6, pl. 1, figs. 6, 7, 1925. Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 168, pl. 7, figs. 8a, b, 1926. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 59, pl. 11, fig. 5, 1932. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 7, fig. 5, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 35, pl. 13, figs. 7-9, 1935.

This species is a conspicuous form with an elongate tapering test, rounded at the apertural end. The surface ornamentation consists of 6 to 8 raised plate-like continuous longitudinal costae, the edges of some being serrated.

It ranges throughout the Yazoo clay; some samples failed to yield any specimens, although they were abundant at some localities.

BULIMINA JACKSONENSIS Cushman var. CUNEATA Cushman

Plate VII, 18

Bulimina jacksonensis Cushman var. *cuneata* Cushman, Contr. Cushman Lab. Foram. Res., Vol. 2, p. 35, 1926; U. S. Geol. Survey Prof. Paper 181, p. 35, pl. 13, figs. 10, 11, 1935.

The variety differs from the species proper in being more tapered, many being larger. The costae are more numerous, 10 to 12, and are finely serrate. In the Yazoo clay of Scott County the variety was the more common. Many fine specimens were obtained, some darkened by internal deposits of pyrite so that the features of the test were clearly revealed.

BULIMINA OVATA d'Orbigny

Plate VII, 23

Bulimina ovata d'Orbigny, Foram. Foss. Bass. Tert. Vienne, p. 185, pl. 11, figs. 13, 14, 1846. Cushman and Ponton, Contr. Cushman Lab. Foram. Res., Vol. 8, p. 67, pl. 9, figs. 1, 2, 1932. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 35, pl. 13, figs. 15, 16, 1935. Cushman and Parker, Contr. Cushman Lab. Foram. Res., Vol. 13, p. 47, pl. 6, figs. 4, 5, 1936. Toulmin, Jour. Pal., Vol. 15, no. 6, p. 597, pl. 80, figs. 25, 26, 1941.

Specimens assigned to this species show some variation in shape and size and may represent two or three species. All are circular in end view and have slightly inflated elongate chambers. Some specimens are translucent. Well preserved individuals show a plate-like tooth. This form is common throughout the Jackson samples.

Genus ENTOSOLENIA Ehrenberg, 1848

ENTOSOLENIA INCURVATA (?) Green

Plate VII, 11

Lagena incurvata Green, Amer. Jour. Micr. Pop. Sci., Vol. 6, p. 46, pl. opp. p. 45, fig. 3, 1881. (Description and horizon not given).

Test minute, somewhat compressed, elliptical in outline, periphery bluntly angled; wall translucent; aperture circular, at end of short compressed neck, internal tube curved against wall.

Since only a figure without the description or horizon appears in the reference, it is difficult to place definitely the Jackson species with the English form so that its assignment at the present is merely tentative. It is found rarely in the finer screenings of lower Jackson samples from Scott County.

ENTOSOLENIA MARGINATA (Walker and Boys)

Plate VII, 10

Serpula (Lagena) marginata Walker and Boys, Minute Shells, p. 2, pl. 1, fig. 7, 1784.

Vermiculum marginatum Montagu, Testacea Britannica, or natural history of British shells, marine, land and fresh-water, including the most minute, p. 254, 1803.

Lagena marginata (Walker and Jacob) Cushman, Contr. Cushman Lab. Foram. Res., Vol. 5, pt. 3, p. 71, pl. 11, fig. 15, 1929; Vol. 15, pt. 3, p. 66, pl. 11, figs. 1, 3, 1939.

Test small, compressed, oval to elliptical, translucent, surrounded with a longitudinal thin peripheral carina, apertural end with a short neck, grooved on each side.

This form is found sparingly in the lower Jackson material from Scott County. Tests are so minute that they are easily overlooked.

Genus VIRGULINA d'Orbigny, 1826

VIRGULINA ALABAMENSIS Cushman and McGlamery

Plate VII, 22

? *Virgulina bramlettei* Galloway and Morrey, Cushman and McGlamery, U. S. Geol. Survey Prof. Paper 189-D, p. 107, pl. 25, fig. 10, 1938. Cushman, Contr. Cushman Lab. Foram. Res. Spec. Pub. No. 9, pl. 3, fig. 8, 1937.

Virgulina alabamensis Cushman and McGlamery, Contr. Cushman Lab. Foram. Res., Vol. 15, pt. 3, p. 48, pl. 9, figs. 7a, b, 1939.

"Test elongate, somewhat compressed, about three times as long as broad, sides for the most part nearly parallel or decreasing in breadth toward the apertural end which is somewhat truncate, initial end triserial, bluntly pointed, periphery rounded; chambers numerous, very distinct, about three pairs of biserial ones in the adult, slightly inflated; sutures distinct, curved, slightly depressed; wall thin and nearly transparent, very finely perforate, smooth and polished; aperture rather large, comma-shaped, oblique, with a slight lip. Length 0.45-0.50 mm.; breadth 0.12-0.15 mm.; thickness 0.10 mm."

Jackson specimens, identified as belonging to this species, compare very favorably with the described Oligocene form, but on each the aperture tends to be in a more terminal position and to have a slight lip. Those from the lower Yazoo clay are relatively short, but elongate specimens are present in the upper beds. This form is found sparingly in a few Scott County samples from both lower and upper Yazoo clay.

VIRGULINA DIBOLLENSIS Cushman and Applin

Plate VII, 16

Virgulina dibollensis Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 168, pl. 7, figs. 7a-c, 1926. Howe, Jour. Pal., Vol. 2, p. 175, 1928. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 66, pl. 11, fig. 1, 1932. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 36, pl. 14, figs. 1-3, 1935.

"Test much compressed, very slender, tapering, about 4½ times as long as broad, the whole test twisted through about 180°, initial end rounded, greatest breadth at about three-quarters of the length from the initial end; periphery rounded;

chambers distinct, 15 or more, early ones spiral, later ones biserial, the last three chambers, making up half the test; sutures oblique, distinct, slightly depressed; wall thin, punctate, the punctae in longitudinal rows; aperture elongate, elliptical. Length, 0.60 mm.; maximum breadth, 0.12-0.15 mm."

This species is very common throughout the Jackson formation of Scott County.

VIRGULINA RECTA (?) Cushman

Plate VII, 17

Virgulina recta Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 12, pl. 1, figs. 31a, b, 1933.

Virgulina sp. ?, Cushman, U. S. Geol. Survey Prof. Paper 129, p. 92, pl. 16, figs. 2, 3, 1922; U. S. Geol. Survey Prof. Paper 181, p. 36, pl. 14, figs. 4a, b, 1935.

One specimen that may belong to this species came from a sample of lower Yazoo clay at Forest.

VIRGULINA RECTA Cushman var. HOWEI Cushman

Plate VII, 13, 14, 15

Virgulina recta Cushman var. *howei* Cushman, Contr. Cushman Lab. Foram. Res., Spec. Pub. No. 6, p. 47, pl. 7, fig. 4, 1936.

"Variety differing from the typical in the ornamentation of the wall, consisting of fine longitudinal costae, and the basal angles of the chambers which often distinctly overhang."

Specimens of this little variety were found in a sample of uppermost Yazoo clay from a shallow test hole approximately 3 miles southwest of Morton and in a test hole near the Smith-Rankin County line in the southwest corner of Scott County.

Genus BOLIVINA d'Orbigny, 1839

BOLIVINA ATTENUATA Cushman

Plate VII, 33

Bolivina attenuata Cushman, Contr. Cushman Lab. Foram. Res., Vol. 2, p. 30, pl. 4, fig. 4, 1926. U. S. Geol. Survey Prof. Paper 181, p. 36, pl. 14, fig. 5, 1935.

A few small tests that appear to belong to this species were found sparingly in some of the finer screenings of lower Yazoo clay samples from Scott County.

BOLIVINA DANVILLENSIS Howe and Wallace

Plate VII, 19

Bolivina danvillensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 56, pl. 11, figs. 8a, b, 1932.

This species is distinguishable from other members of the genus in the Jackson by the lobate depressed areas along the sutures in the later portion of the test.

Specimens which are similar to those described by Howe and Wallace were found in Scott County samples and ranged throughout the Yazoo clay. Some specimens are considerably compressed with a slight keel along the periphery of the last-formed chamber.

BOLIVINA GARDNERAE Cushman

Bolivina cf. B. punctata Cushman, U. S. Geol. Survey Prof. Paper 133, p. 19, pl. 2, fig. 1, 1923.

Bolivina gardnerae Cushman, Contr. Cushman Lab. Foram. Res., Vol. 2, p. 31, pl. 4, figs. 7a, b, 1926. U. S. Geol. Surv. Prof. Paper 181, p. 37, pl. 14, figs. 6, 7, 1935.

"Test elongate, compressed, slightly tapering from the rounded initial end, periphery rounded, test broadly oval in transverse section, sides nearly parallel; chambers numerous, slightly inflated, distinct; sutures distinct, depressed; wall coarsely perforate, without a definite arrangement of the perforations; aperture elongate. Maximum length 0.40 mm."

Specimens of this form were found in lower Yazoo clay samples from Scott County.

BOLIVINA GRACILIS Cushman and Applin

Plate VII, 20

Bolivina gracilis Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 167, pl. 7, figs. 1, 2, 1926. Howe and Wallace, La. Dept. Conservation Geol. Bull. 2, p. 57, 1932. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 37, pl. 14, figs. 8-10, 1935.

This form is easily recognized because of its slender slightly compressed test and the coarse perforations of the wall.

It is one of the more common species in the samples examined and ranges throughout the Jackson formation.

BOLIVINA JACKSONENSIS Cushman and Applin

Plate VII, 21, 27

Bolivina jacksonensis Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 167, pl. 7, figs. 3, 4, 1926. Howe and Wallace, Louisiana Dept. Cons. Geol. Bull. 2, p. 59, pl. 11, fig. 11, 1932. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 3, fig. 3, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 37, pl. 14, figs. 11-13, 1935.

The test of this species is compressed, finely punctate, and usually the wall is thin and translucent with distinct sutures. Some specimens are slightly keeled. A few of those noted exhibit faint plications on the initial portion but none clearly enough to merit assignment to the variety "striatella."

It is one of the most common species in the Jackson formation.

BOLIVINA JACKSONENSIS Cushman and Applin var. STRIATELLA Cushman and Applin

Bolivina jacksonensis Cushman and Applin var. *striatella* Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 167, pl. 7, figs. 5, 6, 1926. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 3, fig. 4, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 37, pl. 14, figs. 14-18, 1935.

Cushman reports this variety from several localities of the Jackson formation in Mississippi. None of the specimens obtained in the Scott County clays appeared to be sufficiently striated to merit variety designation.

BOLIVINA MEXICANA Cushman

Bolivina mexicana Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, pt. 4, p. 81, pl. 12, fig. 2, 1926. Jour. Pal., Vol. 1, no. 2, p. 161, pl. 28, fig. 9, 1927.

"Test much compressed, the early portion with a slight keel, later chambers developing a wider keel; chambers of the early portion low, several times as broad as high, gradually increasing in height as added until in the adult the chambers are only slightly greater in width than in height, inflated slightly in later development; sutures distinct, in the early portion appearing at the surface as a double line between the chambers, in later development less marked and slightly obscured by a slight imbrication of the chambers; wall smooth, finely punctate; aperture elongate with a slight lip. Length up to 1.2 mm."

The species is present in upper Jackson samples from Scott County.

BOLIVINA MEXICANA Cushman var. HORIZONTALIS Cushman

Plate VII, 28

Bolivina mexicana Cushman var. *horizontalis* Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, pt. 4, p. 82, pl. 12, figs. 5a-b, 1926. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 58, pl. 11, fig. 10, 1932.

Tests of this form are much compressed, smooth and finely punctate, and have a keel that widens with each chamber and that exhibits a serrate appearance by horizontal angulations. Some of the specimens studied show a slightly irregular clear shell thickening along the median line.

This form ranges throughout the Yazoo clay but was not found in any degree of abundance in the Scott County samples.

Genus BITUBULOGENERINA Howe, 1934

BITUBULOGENERINA HOWEI Cushman

Plate VII, 25

Gaudryina sp. Cushman, U. S. Geol. Survey Prof. Paper 129F, p. 127, pl. 29, fig. 6, 1922.

Bitubulogenerina sp. Howe, Jour. Pal., Vol. 8, pl. 51, fig. 4, 1934.

Bitubulogenerina howei Cushman, Contr. Cushman Lab. Foram. Res., Vol. 11, pt. 1, p. 20, pl. 3, figs. 10-12, 1935.

"Test elongate, early portion tapering, triserial, later adult portion biserial, with the sides nearly parallel, very slightly compressed, periphery rounded, lobulate; chambers distinct, somewhat inflated, the earlier triserial ones increasing gradually in size, later ones very slightly increasing as added; sutures distinct, strongly depressed; wall calcareous, finely perforate, exterior, covered with numerous small, bluntly spinose projections; aperture in the adult terminal, occupying a median position, large and rounded, with a distinct, raised lip. Length 0.28-0.33 mm.; breadth 0.12-0.15 mm.; thickness 0.10-0.12 mm."

This species is spinose over the entire test, whereas *B. mauricensis* Howe from the Claiborne is smooth on the initial triserial portion.

A few specimens which appear to belong to this species, described by Cushman from the Oligocene Red Bluff clay of Mississippi, were found in samples of basal Yazoo clay from two localities in Scott County.

BITUBULOGENERINA MONTGOMERYENSIS Howe

Plate VII, 24

Bitubulogenerina montgomeryensis Howe, Jour. Pal., Vol. 8, p. 421, pl. 51, figs. 9a, b, 1934.

"Test elongate, free, somewhat compressed; the first few chambers rounded and triserial in arrangement, quickly becoming biserial, and as the chambers are added they become more and more angular, the angulations being above the middle of the chamber; wall nearly smooth above the angulation, but spinose below; aperture siphonate with a short neck, the phialine lip being oval in outline, the apertural opening being small and spade-shaped. Length 0.23 mm.; width 0.11 mm."

A few specimens of this peculiarly shaped minute fossil were found in Scott County samples of the basal Yazoo clay and Moodys Branch marl. The species appears to be relatively rare.

Genus TRITUBULOGENERINA Howe, 1939

TRITLBULOGENERINA MAURICENSIS Howe

Plate VII, 29

Tritubulogenerina mauricensis Howe, La. Dept. Cons. Geol. Bull. 14, p. 69, pl. 8, figs. 34, 35, 1939.

"Test small short, broad, composed of a number of inflated chambers arranged triserially, the basal portions of the chambers tending to project beyond the suture line which produces a spiny effect at the initial end when viewed laterally; wall hyaline, granular; sutures depressed; aperture large, terminal, ovate, with a broad collar."

Basal Jackson samples from test holes in the northwestern part of Scott County yielded a few small granular specimens that appear to belong to this species described from the Cook Mountain of Louisiana.

Genus REUSSELLA Galloway, 1933

REUSSELLA EOCENA (Cushman) var.

Plate VII, 31a, b, 32, 34a, b

Reussia eocena Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 13, pl. 1, fig. 25, 1933; U. S. Geol. Survey Prof. Paper 181, p. 38, pl. 15, figs. 4, 5, 1935.

"Test short and broad, pyramidal, three-sided, widest above the middle, triangular in transverse section, the sides in the adult deeply concave, in the young stages nearly flat; angles in the young sharp, in the adult becoming thick and rounded; surface smooth; aperture at the inner border of the last-formed chamber. Maximum length 0.80 mm."

Specimens obtained differ from the described species in the following characteristics: walls of adult test only slightly concave, sutures are limbate but flush with the surface, and the top of each of the last three chambers is deeply concave as seen from the apertural view. This variety was found in several samples of lower Yazoo clay and Moodys Branch material from Scott County. A very similar form is present in the Byram marl at Vicksburg.

REUSSELLA RECTIMARGO (Cushman)

Plate VII, 30

Verneuilina rectimargo Cushman, U. S. Geol. Survey Prof. Paper 129-F, p. 127, pl. 29, figs. 4, 5, 1922.

"Test elongate, triangular in cross section, early portion tapering, adult portion with the sides nearly parallel and straight; chambers numerous, arranged triserially; sutures not depressed, often slightly limbate; sides of the test flattened or very slightly concave; peripheral angles rounded; aperture slightly elongate at the base of the inner margin of the last-formed chamber; wall finely punctate. Length 1 millimeter or less."

A few very small specimens, that, with the exception of size, exhibit characteristics of the species described from the Vicksburg formation, were found in a lower Yazoo clay sample from a test hole at Forest.

REUSSELLA cf. SUBROTUNDATA (Cushman and Thomas)

Reussia subrotundata Cushman and Thomas, Jour. Pal., Vol. 4, no. 1, p. 38, pl. 3, figs. 7a-c, 1930.

Reussella subrotundata (Cushman and Thomas), Howe, La. Dept. Cons. Geol. Bull. 14, p. 70, pl. 8, figs. 40-42, 1930.

A few specimens from lower Jackson material from Scott County are referred to this species. They show variation in the amount of rounding of the angles and shape of chambers.

Genus UVIGERINA d'Orbigny, 1826

UVIGERINA COCOAENSIS Cushman

Plate VIII, 9

Uvigerina cocoaensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, p. 68, pl. 10, fig. 12, 1925. Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 174, pl. 8, fig. 15, 1926. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 3, fig. 13, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 39, pl. 15, figs. 11-13, 1935.

"Test of medium size for the genus, elongate, fusiform, greatest width slightly above the middle, periphery very slightly lobulate; chambers rather few, inflated, evenly rounded; sutures slightly depressed; wall ornamented with coarse longitudinal costae, not usually confluent with those of the chambers above or below, becoming lower and less conspicuous in later chambers, the last-formed chamber in the adult usually smooth, about 12 to 16 costae in the complete circumference in the widest region; wall finely punctate; apertural end with a short cylindrical neck and phialine lip. Maximum length 0.80 mm.; width 0.30-0.35 mm."

This is a fairly common species throughout the Yazoo clay in Scott County.

UVIGERINA COOKEI Cushman

Plate VIII, 7

Uvigerina cookei Cushman, U. S. Geol. Survey Prof. Paper 181, p. 39, pl. 15, figs. 14-16, 1935.

"Test of large size for the genus, elongated, subcylindrical, slightly fusiform, greatest width above the middle, periphery slightly lobulate; chambers numerous, inflated, evenly rounded; sutures slightly depressed; wall ornamented with sharp, low, longitudinal costae, in part confluent with those above and below, usually reduced on the last-formed chamber, about 24 to 30 costae in the complete circumference in the widest region; wall finely punctate; apertural end with a very short cylindrical neck and wide phialine lip. Maximum length 1.20 mm.; width 0.35-0.40 mm."

This species was fairly abundant in some of the lower Jackson samples of Scott County.

UVIGERINA DANVILLENSIS Howe and Wallace

Plate VIII, 1

Uvigerina danvillensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 62, pl. 12, fig. 5, 1932.

"Test subfusiform, greatest diameter near the midportion, about twice as long as broad, almost circular in cross section; chambers inflated, arranged in a loose triserial series; sutures more or less indistinct, depressed; all chambers except the last possess high, plate-like costae, some extending across two or three chambers, the initial end ornamented with four of these costae extending vane-like well beyond the posterior limits of the test; wall calcareous, finely perforate, costae clear, glassy; aperture circular, eccentric, at the end of a moderately long neck, surrounded by a phialine lip. Length 0.5 mm."

A few samples of upper Yazoo clay from Scott County yielded numerous specimens of this characteristically costate species.

UVIGERINA ELONGATA Cole

Plate VIII, 3

Uvigerina elongata Cole, Bull. Am. Paleontology, Vol. 14, No. 51, p. 26, pl. 4, figs. 2, 3, 1927. Cushman and Edwards, Contr. Cushman Lab. Foram. Res., Vol. 13, p. 78, pl. 11, figs. 15, 16, 1937. Cushman, Contr. Cushman Lab. Foram. Res., Vol. 15, pt. 3, p. 65, pl. 11, fig. 11, 1939.

"Test small, elongate, composed of a compact, early portion, with a tendency for the final chamber to be added uniserially; surface slightly hispid; aperture an elongate neck and with a narrow, rimmed phialine neck. Length 0.35-0.40 mm."

Small hispid specimens are present in the Jackson, particularly the lower Yazoo clay. The Scott County forms resemble very closely the topotype specimens figured by Cushman. Howe lists the species from the Cook Mountain formation of Louisiana.

UVIGERINA GARDNERAE Cushman

Plate VIII, 8

Uvigerina gardnerae Cushman, in Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 175, pl. 8, figs. 16, 17, 1926. Cole, Bull. Am. Paleontology, Vol. 14, no. 53, p. 213 (13), pl. 2, fig. 5, 1928. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 63, pl. 12, fig. 6, 1932. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 40, pl. 15, figs. 18, 19, 1935. Cushman, Contr. Cushman Lab. Foram. Res., Vol. 13, pt. 3, p. 79, pl. 11, figs. 19, 20, 1937.

"Test of medium size for the genus, much elongated, slender, early portion fusiform, later portion with the chambers somewhat loosely arranged, periphery somewhat lobulate; chambers numerous, inflated, especially the later ones, earlier ones with the basal end of the chambers tending to overhang the preceding ones; wall ornamented with longitudinal costae in the earlier portion, the costae not confluent with those of chambers above or below, costae later tending to break up into lines of spines, and the later portion of the test in adults generally hispid, over 20 costae in the complete circumference before breaking into spines; apertural end with a slightly tapering subcylindrical neck and slight phialine lip. Maximum length 0.80 mm.; width 0.25 mm."

This is one of the most common species in the Jackson formation and is found in nearly every sample examined. Specimens vary from the shortened forms to those that are somewhat elongate.

UVIGERINA GARDNERAE Cushman var. TEXANA Cushman and Applin

Plate VIII, 4

Uvigerina gardnerae Cushman var. *texana* Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 175, pl. 8, fig. 13, 1926. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 64, pl. 12, figs. 3, 9, 1932. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 3, fig. 15, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 40, pl. 15, fig. 20, 1935. Contr. Cushman Lab. Foram. Res., Vol. 13, pt. 3, p. 79, pl. 11, fig. 18, 1937.

"Variety differing from the typical form in being much more elongate; the later portion is somewhat less in diameter than the earlier part. Length 0.60 mm.; breadth 0.20 mm."

Many specimens of this elongate variety show hispid features on the later portions of the tests. This variety was found throughout the Jackson formation and beautiful specimens were especially abundant in some of the samples of the upper Yazoo clay.

UVIGERINA GLABRANS Cushman

Plate VIII, 2

Uvigerina glabrans Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 13, pl. 1, fig. 28, 1933; U. S. Geol. Survey Prof. Paper 181, p. 40, pl. 15, fig. 21, 1935. Contr. Cushman Lab. Foram. Res., Vol. 13, pt. 3, p. 80, pl. 11, fig. 21, 1937.

"Test of medium size for the genus, elongated, subcylindrical, or slightly fusiform, greatest width usually below the middle, periphery only slightly lobulate; chambers comparatively few, inflated, evenly rounded; sutures very slightly depressed; wall smooth, or with faint traces of costae near the initial end, finely perforate; apertural end truncate, with a short delicate cylindrical neck and phialine lip, the neck often broken. Maximum length 0.75 mm.; breadth 0.30-0.35 mm."

Smooth specimens and some with faint costae were found in several samples of lower Yazoo clay in Scott County.

UVIGERINA JACKSONENSIS Cushman

Uvigerina jacksonensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, pt. 3, p. 67, pl. 10, fig. 13, 1925; Jour. Pal., Vol. 1, p. 163, pl. 25, fig. 3, 1927. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 65, pl. 12, figs. 7, 8, 1932. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 40, pl. 16, figs. 1-3, 1935; Contr. Cushman Lab. Foram. Res., Vol. 13, pt. 3, p. 81, pl. 12, figs. 4, 5, 1937.

"Test large for the genus, stout, broadly fusiform, greatest width at about the middle, periphery slightly lobulate; chambers rather few, inflated; sutures somewhat depressed, basal part of chamber not conspicuously overhanging, evenly curved; wall ornamented with coarse longitudinal costae, in the early portion usually limited to the individual chamber, in the adult portion usually becoming confluent with those of the adjacent chambers above and below, outer edge of the costae entire; about 18 to 22 costae in the complete circumference in the widest region; wall rather coarsely punctate; apertural end with a tendency in the last-formed chamber to lose or reduce the costae, with a cylindrical neck of medium length and phialine lip. Maximum length 0.90 mm.; width 0.45 mm."

Specimens referred to this species were found in several representative samples of the Jackson formation from Scott County. The form is not abundant but appears to range throughout the formation. It has been reported from several localities in the state.

UVIGERINA TOPILENSIS Cushman

Plate VIII, 5

Uvigerina topilensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, p. 5, pl. 1, figs. 5a, b, 1925. Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 176, pl. 8, fig. 14, 1926. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 3, fig. 14, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 41, pl. 16, fig. 4, 1935; Contr. Cushman Lab. Foram. Res., Vol. 13, pt. 3, p. 83, pl. 12, fig. 14, 1937.

"Test generally fusiform, broadest in the middle, initial and apertural ends both rounded; chambers irregularly spiral, inflated; sutures distinct, depressed; wall ornamented with a very few costae, progressively decreasing in height toward the apertural end of the test and usually continuous from one chamber to another, the last-formed chamber usually smooth; wall finely punctate, the costae on the earliest portion sometimes projecting backward into plate-like processes; aperture with a very narrow cylindrical neck. Length 0.70 mm.; breadth 0.30 mm."

Scott County specimens are elongate with the last 2 to 4 chambers arranged nearly uniserially. Rarely specimens have two apertures separately developed on the last chamber. Species ranges through the Yazoo clay.

UVIGERINA YAZOOENSIS Cushman

Plate VIII, 6

Uvigerina yazooensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 13, pl. 1, fig. 29, 1933; U. S. Geol. Survey Prof. Paper 181, p. 41, pl. 16, figs. 5, 6, 1935; Contr. Cushman Lab. Foram. Res., Vol. 13, pt. 3, p. 85, pl. 12, figs. 16, 17, 1937.

"Test small, elongate, fusiform, greatest width toward the apertural end, periphery strongly lobulate; chambers numerous, inflated; sutures strongly depressed, the basal portion of the chamber overhanging the preceding ones; wall ornamented with sharp, longitudinal costae, limited to the individual chamber, those preceding the succeeding chambers not usually in the same line, the outer edge of the costae often serrate, about 22 to 26 costae in the complete circumference in the widest region; wall rather coarsely punctate; apertural end with a short, narrow cylindrical neck and phialine lip. Maximum length 0.70 mm.; width 0.28 mm."

A few specimens from the upper Yazoo clay in Scott County have been assigned to this species, but it was not recognized in the material from the basal portion of the Jackson formation. A greatly elongated form came from a test hole sample obtained from the top of the formation in the southwest corner of the county. This elongated type is the one figured and may be a variety of the typical.

UVIGERINA sp.

Plate VIII, 10

Test elongate, tapering, broadest at apertural end; chambers numerous, inflated, rapidly expanding, evenly rounded in later portion; sutures distinct, depressed; initial part of test ornamented by a few longitudinal costae which project beyond base, later portion smooth; apertural end with a short neck at center of base of last-formed chamber. Length 0.4 mm.

This specimen came from test hole J32 in the uppermost Yazoo clay, southwest corner of Scott County.

Genus ANGULOGERINA Cushman, 1927

ANGULOGERINA DANVILLENSIS Howe and Wallace

Plate VIII, 15

Angulogerina danvillensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 56, pl. 12, fig. 2, 1932.

"Test elongate, fusiform, the adult one-half of the test being triangular in shape with almost concave faces; chambers numerous, arranged in an irregular triserial series, the earlier chambers slightly inflated and covered with coarse longitudinal costae which do not extend beyond the limits of each chamber; sutures fairly distinct, depressed; wall calcareous, finely perforate; aperture, a circular opening at the end of a fairly long neck, provided with a faint phialine lip. Length 0.41 mm."

This species was identified in one sample of upper Yazoo clay from Scott County.

ANGULOGERINA OCALANA Cushman

Plate VIII, 14

Angulogerina ocalana Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 14, pl. 1, fig. 30, 1933; U. S. Geol. Survey Prof. Paper 181, p. 41, pl. 16. figs. 7, 8, 1935.

"Test small for the genus, elongate, fusiform, periphery very slightly lobulate, somewhat triangular in section, the angles rounded, especially in the early portion; wall ornamented with numerous very fine, slightly raised costae, the outer edge broken into a finely serrate line; apertural end with the chambers somewhat loosely arranged, the costae less prominent or nearly wanting, the chambers more definitely triangular, angles sharper;

apertural end extended into a short neck with a slight lip. Maximum length 0.35 mm.; width 0.15 mm."

Specimens which compare with this finely plicated small species range throughout the Jackson formation of Scott County.

ANGULOGERINA MULTICOSTATA Bergquist, n. sp.

Plate VIII, 22, 23

Test elongate, very slender, initial end bluntly pointed; chambers numerous, slightly inflated; last half of adult test nearly uniserial with each chamber flattened or concave on inner side; sutures distinct; surface ornamented by numerous closely spaced, longitudinal low costae, not continuous from one chamber to another; aperture elliptical, at end of a short compressed neck with a slight lip. Length 0.65 mm.; diameter 0.17 mm.

Near top of Yazoo clay in Scott County.

Holotype: Top Yazoo clay, test hole J177, 27 feet beneath surface, 3½ miles southwest of Morton; Type slide VIII, 22, Mississippi Geological Survey.

ANGULOGERINA MULTICOSTATA Bergquist, n. sp.
var. YAZOOENSIS Bergquist, n. var.

Plate VIII, 16, 17

Variety differs from typical form in being smooth and having the last two chambers compressed and somewhat twisted and very concave on inner side. Length 0.40 mm.; maximum diameter 0.10 mm.

Upper Yazoo clay, Scott County.

Holotype: Upper Yazoo clay, test hole J40, 15 to 18 feet beneath the surface, 4 miles south of Morton; Type slide VIII, 16, Mississippi Geological Survey.

ANGULOGERINA RUGOPLICATA Cushman

Plate VIII, 12

Angulogerina rugoplicata Cushman, Contr. Cushman Lab. Foram. Res., Vol. 11, p. 33, pl. 5, figs. 5a, b, 1935; idem, Vol. 14, pt. 4, p. 88, pl. 15, fig. 20, 1938.

"Test about twice as long as broad, generally triangular in end view, the sides slightly concave, and the angles in the adult truncate, somewhat fusiform in side view, greatest diameter at about the middle; chambers distinct, strongly concave at the base, irregular, increasing in height toward the apertural end; sutures strongly depressed; wall distinctly perforate, with slight traces of longitudinal striae; aperture circular, terminal, with a very short, cylindrical neck and a very slight, rounded lip. Length 0.30 mm.; diameter 0.15 mm."

Specimens assigned to this species came from a sample of basal Yazoo clay from a test hole beside the road, 3½ miles northwest of Forkville.

Genus TRIFARINA Cushman, 1923

TRIFARINA ADVENA Cushman

Plate VIII, 13

Trifarina bradyi Cushman var. *advena* Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, pt. 4, p. 87, 1926; U. S. Geol. Survey Prof. Paper 181, p. 42, pl. 16, figs. 10a, b, 1935.

Trifarina advena Cushman, Contr. Cushman Lab. Foram. Res., Vol. 15, pt. 3, p. 66, pl. 11, fig. 15, 1939.

Test elongate, tapering at each end, triangular in transverse section, sides flattened to slightly convex, surface coarsely punctate, angles rounded to carinate; sutures distinct and on some specimens are deeply depressed and give an irregular to somewhat twisted effect to test; aperture rounded, at end of short neck.

Tests show variations in amount of triangularity, some being somewhat rounded and having very little development of the angle carinae. The species ranges throughout the Jackson formation in Scott County.

FAMILY ELLIPSOIDINIDAE

Genus PLEUROSTOMELLA Reuss, 1860

PLEUROSTOMELLA CUBENSIS Cushman and Bermudez

Plate VIII, 11

Pleurostomella alazanensis Cushman var. *cubensis* Cushman and Bermudez, Contr. Cushman Lab. Foram. Res., Vol. 13, p. 17, pl. 1, figs. 64, 65, 1937.

Pleurostomella cubensis Cushman and Bermudez, Contr. Cushman Lab. Foram. Res., Vol. 15, pt. 3, p. 67, pl. 11, figs. 25, 26, 1939.

Test fusiform, chambers inflated; sutures distinct, slightly depressed; wall smooth, finely punctate; aperture an elongate slit in oblique apertural face.

A single specimen was found in a sample of basal Yazoo clay from test hole J84 drilled by a roadside approximately 4½ miles northwest of Forkville.

Genus **ELLIPSONODOSARIA** A. Silvestri, 1900

ELLIPSONODOSARIA COCOAENSIS (Cushman)

Plate V, 11, 12

Nodosaria sp. Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 170, pl. 7, fig. 17, 1926.

Nodosaria cocoaensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, p. 66, pl. 10, figs. 5, 6, 1925; Jour. Pal., Vol. 1, p. 153, pl. 24, fig. 1, 1927.

Dentalina cocoaensis Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 2, fig. 5, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 19, pl. 8, figs. 1, 2, 1935.

Ellipsonodosaria cocoaensis (Cushman), Contr. Cushman Lab. Foram. Res., Vol. 15, pt. 3, p. 68-69, pl. 11, figs. 27-33, 1939.

Nearly complete adult specimens of this long slender species are common in the Yazoo clay at several localities in Scott County.

Genus **ELLIPSOLAGENA** A. Silvestri, 1923

ELLIPSOLAGENA sp.

Plate VII, 12

Test minute, monothalmous, slightly compressed with faint carina development at periphery near apertural end; ovate in side view; wall translucent; aperture a terminal elongate slit with a raised lip on each side, one being slightly higher, and from this the internal neck curves back against the wall.

This form was found very sparingly in the finer screenings of lower Jackson samples from Scott County.

FAMILY ROTALIIDAE

Genus **DISCORBIS** Lamarck, 1804

DISCORBIS ALVEATA Cushman

Plate VIII, 18

Discorbis alveata Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 16, pl. 2, figs. 4a-c, 1933; U. S. Geol. Survey Prof. Paper 181, p. 44, pl. 17, figs. 4a-c, 1935.

"Test planoconvex, dorsal side raised in a low spire, ventral side nearly flat, periphery acute and slightly keeled; chambers distinct, about 5 in the adult whorl, of uniform shape, increasing gradually in size as added, the ventral side with the inner portion broken up into a series of channels radiating from the umbilicus; sutures distinct, slightly limbate on the dorsal side, strongly curved, flush with the surface, on the ventral side nearly radial, slightly curved and distinctly depressed; wall smooth except for the channeling of the umbilical area on the ventral side; aperture narrow, at the umbilical end of the chamber. Diameter 0.35 mm.; height 0.12 mm."

Cushman's holotype came from the Jackson at Garlands Creek. A few specimens from the lower Yazoo clay and one from the uppermost portion of the formation in Scott County belong to this species.

DISCORBIS ASSULATA (?) Cushman

Discorbis assulata Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 15, pl. 2, figs. 2a-c, 1933; U. S. Geol. Survey Prof. Paper 181, p. 44, pl. 17, figs. 1, 2, 1935.

Three small specimens from samples of basal Yazoo clay from test holes in Scott County may belong to this species. All the listed features check except that the specimens are coarsely perforate, so that the surface has a roughened appearance.

DISCORBIS GLOBULO-SPINOSA Cushman

Plate VIII, 21

Discorbis globulo-spinosa Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 14, pl. 2, figs. 1a-c, 1933; U. S. Geol. Survey Prof. Paper 181, p. 43, pl. 16, figs. 14a-c, 1935.

This form is an easily recognized species. The small test is flat on the ventral side and strongly convex dorsally with a raised ridge on the inner area of the whorls that is usually produced into blunt spines in the central portion. It was found to be fairly common in the Moodys Branch marl and in one sample of lower Yazoo clay in Scott County. Cushman described the species from the Jackson formation at Jackson and also listed it from Garlands Creek.

DISCORBIS HEMISPHAERICA Cushman

Plate VIII, 19, 20

Discorbis hemisphaerica Cushman, Contr. Cushman Lab. Foram. Res., Vol. 7, p. 59, pl. 7, figs. 14a-c, 1931. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 3, figs. 17, 18, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 43, pl. 16, figs. 13a-c, 1935.

"Test small, hemispherical, the ventral side flattened, dorsal side strongly convex, composed of several whorls, last-formed one with 4 chambers, ventral peripheral portions rounded; chambers of the early whorls somewhat covered by a secondary clear growth, later chambers more distinct, somewhat narrowed, smooth; sutures distinct, oblique, slightly depressed, on the ventral side radial; wall coarsely and conspicuously perforate, less distinctly so on the ventral side, which is peculiar, as the last-formed whorl of chambers only partly covers the earlier ones; aperture a curved arched opening on the ventral side of the test from near the periphery, well back from the umbilical region, developing a slight raised lip and apertural face. Diameter 0.35 mm.; thickness 0.20-0.30 mm."

This species was common in the basal Jackson of some of the Scott County test holes. Cushman's holotype came from Jackson; he also noted it from Garlands Creek.

Genus VALVULINERIA Cushman, 1926

VALVULINERIA TEXANA Cushman and Ellisor

Plate VIII, 24, 25

Valvulineria texana Cushman and Ellisor, Contr. Cushman Lab. Foram. Res., Vol. 7, pt. 3, p. 56, pl. 7, figs. 9a-c, 1931. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 70, pl. 13, figs. 6a, b, 1932.

"Test small, slightly longer than broad, periphery broadly rounded; chambers comparatively few, usually five making up the last-formed whorl in the adult, inflated on the ventral side with a distinct prolongation forming a semicircular lip, and extending out over the aperture; sutures distinct, depressed, on the dorsal side very slightly curved, on the ventral side radial; wall smooth, very finely perforate; aperture an elongate slit below the projecting lip in the umbilical region of the ventral side. Diameter 0.36 mm."

This species was found in one sample of lower Yazoo clay and in a few of the samples from the upper part of the formation in Scott County.

Genus GYROIDINA d'Orbigny, 1826

GYROIDINA DANVILLENSIS Howe and Wallace

Plate VIII, 31, 32, 33

Gyroidina danvillensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 69, pl. 13, figs. 3a-c, 1932.

"Test small, trochoid, ventral side steeply convex, dorsal side almost a plane, umbilicus faint; chambers few, about five or six visible on the ventral side, seven or eight visible on the dorsal side, chambers slightly inflated; sutures distinct, depressed, radial; wall calcareous, finely perforate; aperture a low arched opening on the ventral side extending from the umbilicus almost to the periphery, provided with a distinct lip. Diameter 0.2 mm."

The species has fewer chambers visible in the last whorl than has *G. soldani* d'Orbigny var. *octocamerata* Cushman and G. D. Hanna. Some specimens from Scott County are somewhat convex on the dorsal side with clear shell material that tends to obscure the early chambers.

Small tests which have been identified as this species are common in the fine screenings of most of the Jackson samples from Scott County.

GYROIDINA sp.

Plate VIII, 26a, 26b

Test medium-sized, trochoid, ventral side convex with large umbilicus, dorsal side almost a plane, periphery rounded, wall finely punctate; chambers slightly inflated, gradually enlarging, about 10 visible on ventral side; sutures distinct, radial, somewhat limbate, flush with surface in initial part, slightly depressed in later part and on ventral side each terminates in a small pit at edge of umbilicus; aperture a short, low opening along ventral side, extending almost to periphery. Diameter 0.2 mm.

Two specimens of this form were found in a sample of lower Yazoo clay from a test hole J162C on the northeast slope of Bald hill, approximately 2½ miles southwest of Lake.

Figured specimen on type slide VIII, number 26, Mississippi Geological Survey.

Genus ROTALIATINA Cushman, 1925

ROTALIATINA QUADRALOCULA Bergquist, n. sp.

Plate VIII, 27, 28, 29

Test minute, subspherical, composed of about 3 whorls, earlier coils forming a low spire on the dorsal side; chambers distinct, four in last coil comprise most of test; sutures distinct, slightly depressed on last whorl; wall smooth, polished; aperture an elongated low arched slit with a lip, at base of last-formed chamber. Length 0.18 mm.; diameter 0.17 mm.

This minute form is found in the finer screenings and ranges throughout the Jackson of Scott County.

Cotypes: Top of Yazoo clay, test hole J42, 5½ miles southwest of Morton; Type slide VIII, 27, 28, 29, Mississippi Geological Survey.

ROTALIATINA QUADRALOCULA Bergquist, n. sp. var. ELONGATA Bergquist, n. var.

Plate VIII, 30

Variety differs from typical in being longer than broad and in having a higher spire; last coil comprises about one-half of the test. Length 0.23 mm.; diameter 0.12 mm.

This variety is associated with the typical form in the Jackson formation.

Holotype: Basal Jackson, test hole J193, 3½ miles north of Forkville; Type slide VIII, 30, Mississippi Geological Survey.

Genus EPONIDES Montfort, 1808

EPONIDES COCOAENSIS Cushman

Plate VIII, 34, 35

Eponides cocoaensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 4, p. 73, pl. 10, figs. 2a-c, 1928; U. S. Geol. Survey Prof. Paper 181, p. 47, pl. 19, figs. 1, 2, 1935.

"Test planoconvex, dorsal side flattened or very slightly umbonate, ventral side very strongly convex; chambers few, usually four in the last-formed coil, the last one large and occupying nearly half the surface on the ventral side; periphery subacute or even with a blunt keel; sutures distinct and depressed, on the ventral side nearly radiate, on the dorsal curved; wall in well-preserved specimens rather distinctly perforate, although the perforations are not coarse, and occasionally with small spines or papillae scattered over the surface; aperture elongate, semielliptical, at about the middle of the inner margin of the chamber on the ventral side. Diameter 0.50 mm.; thickness 0.45 mm."

A few specimens from Scott County samples indicate this species is found sparingly throughout the Jackson formation. Cushman lists it from 1½ miles south of Shubuta.

EPONIDES JACKSONENSIS (Cushman and Applin)

Plate VIII, 36a, 36b

Pulvinulina jacksonensis Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 181, pl. 9, figs. 24, 25, 1926.

Eponides jacksonensis (Cushman and Applin), Cushman, U. S. Geol. Survey Prof. Paper 181, p. 46, pl. 19, figs. 4-8, 1935.

"Test with a fairly high spire, the periphery not keeled but only slightly rounded, the dorsal side much more convex than the ventral; chambers numerous, 6 or 7 in the last-formed coil; sutures distinct but on the dorsal side very oblique, on the ventral side only slightly curved and somewhat depressed; wall smooth; aperture on the ventral side, forming a distinct angle in the border of the test and extending to the umbilicus. Diameter 1.00 mm."

This form, abundant throughout the Jackson formation, was found in most of the Scott County samples. Clear shell material darkened by mineralization is present along the ventral sutures near the umbilicus of some specimens. Cushman reports this species from Jackson, Garlands Creek, and 1½ miles south of Shubuta.

Genus EPISTOMINA Terquem, 1883

EPISTOMINA ELEGANS (d'Orbigny)

Plate IX, 6, 7

"Nautili *Ammoniformes* sive *trochiformes*," Soldani, Test., Vol. 2, App., pl. 2, fig. R, 1798.

Rotalia (Turbinulina) elegans d'Orbigny, Ann. Sci. Nat., Vol. 7, p. 276, no. 54, 1826.

Epistomina elegans (d'Orbigny) Cushman, U. S. Nat. Mus., Bull. 104, p. 65, pl. 13, figs. 6a-c, 1931. (For the many references to this species see this reference) Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 68, pl. 13, fig. 2, 1932.

This biconvex form with rounded to acute periphery has distinct limbate sutures that are oblique on the dorsal side and radial on the ventral side where they end in a center umbonate mass. The polished surface and suture pattern make this a distinctive type. Though found sparingly throughout the Jackson formation, the largest and most numerous specimens obtained in Scott County came from the upper Yazoo clay.

Genus SIPHONINA Reuss, 1850

SIPHONINA DANVILLENSIS Howe and Wallace

Plate IX, 3a, b, c

Siphonina danvillensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 70, pl. 13, figs. 1a, b, 1932.

"Test biconvex, trochoid; last-formed coil with about five chambers, distinct on the ventral side, but less so on the dorsal; sutures on the ventral side distinct, very slightly depressed, indistinct on the dorsal side; periphery with a broad, thin, denticulate keel; aperture elongate, elliptical, slightly on the ventral side, provided with a distinct neck, and a thin, flaring lip. Diameter 0.52 mm."

The species was found to range throughout the Jackson formation of Scott County.

SIPHONINA JACKSONENSIS Cushman and Applin

Plate IX, 1, 2

Siphonina jacksonensis Cushman and Applin, Am. Assoc. Petr. Geol., Vol. 10, p. 180, pl. 9, figs. 20-23, 1926. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 3, fig. 21, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 48, pl. 20, figs. 2-8, 1935.

"Test much compressed, chambers slightly projecting at the posterior angle, at the periphery, keeled, 5 chambers in the last-formed coil, fairly distinct; sutures very slightly limbate on the dorsal side, spiral suture not prominent; wall ornamented by very numerous small spinose processes, in some specimens distinctly developed so that the periphery of the test is itself spinose, central portion strongly reticulate; aperture elongate, with a slightly projecting neck and lip. Diameter 0.50 mm."

This is one of the most common species in the Jackson formation. Specimens show variations in size, amount of ornamentation, and inflation. Some tests are greatly compressed and somewhat distorted. Others have slight biconvexity and resemble *S. danvillensis* Howe and Wallace, but the differences are not critical enough to merit assignment to that species. Most of the Jackson samples of Scott County yielded abundant specimens, and the species has been reported from numerous localities in the formation in the state.

Genus CANCRIS Montfort, 1808

CANCRIS DANVILLENSIS Howe and Wallace

Plate IX, 11, 12

Cancris danvillensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 67, pl. 13, figs. 4, 5, 1932.

"Test longer than broad, biconvex, the ventral side more strongly convex than the dorsal; periphery acute, outlined by a thin, clear keel; chambers fairly numerous, all can be seen from the dorsal side, about six appear on the ventral side of adult specimens, in younger specimens the last chamber is about one-half the size of the entire test, in more mature specimens the last few chambers become more elongate and extend the periphery so that the outline becomes almost circular; sutures on the dorsal side slightly limbate and strongly curved, on the ventral side strongly depressed, radial and only slightly recurved near the outer end; umbilicus deep and in adult specimens surrounded by prominent bosses caused by the thickening of the inner edges of the chambers; wall smooth, finely perforate; aperture a slit at the inner margin of the last chamber on the ventral side, provided with a thin lip. Length 0.55 mm.; breadth 0.4 mm."

A few well preserved specimens of this species were found in samples from the uppermost portion of the Yazoo clay in Scott County.

FAMILY CYMBALOPORIDAE

Genus CYMBALOPORETTA Cushman, 1928

CYMBALOPORETTA (?) SQUAMMOSA (d'Orbigny)

Plate IX, 26, 27, 28

Cymbaloporetta squammosa (d'Orbigny) Cushman, Contr. Cushman Lab. Foram. Res., Vol. 4, pt. 1, no. 54, p. 7, 1928.

Rare specimens that are referred to this species came from a basal Yazoo clay sample from a test hole in the northwest portion of Scott County.

CYMBALOPORETTA (?) SQUAMMOSA (d'Orbigny) var.

Plate IX, 22, 23

Test conical, minute, composed of few chambers, the last two or three somewhat inflated, surface of each ornamented by stout spines.

Rare specimens which are tentatively referred to this genus and species came from the basal Yazoo clay from a test hole in the northwest portion of Scott County.

FAMILY CASSIDULINIDAE

Genus CERATOBULIMINA Toula, 1915

CERATOBULIMINA ALAZANENSIS Cushman and Harris

Plate IX, 17, 18

Ceratobulimina alazanensis Cushman and Harris, Contr. Cushman Lab. Foram. Res., Vol. 3, pt. 4, no. 51, p. 174, pl. 29, figs. 5a-c, pl. 30, figs. 3-5, 1927.

"Test very slightly longer than broad, periphery broadly rounded, usually 6 chambers in the last-formed whorl; sutures distinct, slightly depressed, not limbate; wall smooth and polished; aperture more elongate than in the older species and nearer the axis of coiling. Length 0.75 mm.; breadth 0.60 mm.; thickness 0.40 mm. The chambers of the last-formed coil gradually become wider and more involute on the dorsal side than in any other older species and in this character resemble the later Tertiary species."

The specimens obtained in Scott County came from test holes in the uppermost Yazoo clay directly below the Forest Hill beds. They compare closely with the described and illustrated material from the Alazon clays of Mexico.

Genus PULVINULINELLA Cushman, 1926

PULVINULINELLA DANVILLENSIS Howe and Wallace

Plate IX, 4a, b

Pulvinulinella danvillensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 71, pl. 13, figs. 7a-c, 1932.

"Test small, almost equally biconvex, almost circular in outline; periphery acute; chambers numerous, about nine in the last-formed coil; sutures distinct, on the ventral side straight, radial, on the dorsal side straight, but intersecting acutely with the previous coil; central area on the ventral side filled with clear calcareous material; wall calcareous, very finely perforate; aperture an elongate slit parallel to the periphery, located in a depressed notch in the apertural face on the ventral side midway between the periphery and the umbilicus. Diameter 0.15 mm.; thickness 0.07 mm."

This tiny species was observed in the finer material of samples obtained from several test holes that penetrated beds throughout the Jackson section in Scott County.

Genus CASSIDULINA d'Orbigny, 1826

CASSIDULINA CRASSA d'Orbigny

Plate IX, 19

Cassidulina crassa d'Orbigny, Voyage dans l'Amerique meridionale, Foraminiferes, p. 56, pl. 7, figs. 18-20, 1839. H. B. Brady, *Challenger* Rept., Zoology, Vol. 9, p. 429, pl. 54, figs. 4, 5, 1884. Cushman, U. S. Nat. Mus., Bull. 71, pt. 2, p. 97, figs. 151a-c (in text), 1911; U. S. Geol. Survey Prof. Paper 129, p. 128, 1922; Prof. Paper 133, p. 24, pl. 3, fig. 7, 1923.

Specimens compared favorably in size, convexity of test, and shape of chambers with those from the Byram marl. They were found in abundance in some of the fine screenings of the Jackson material from Scott County.

CASSIDULINA GLOBOSA Hantken

Plate IX, 13, 14

Cassidulina globosa Hantken, Magy. kir. foldt. int. Evkonyve, Vol. 4, p. 54, pl. 16, fig. 2, 1875 (1876). Cushman, Contr. Cushman Lab. Foram. Res., Vol. 1, p. 56, pl. 9, figs. 25, 26, 1925. Cole, Bull. Am. Paleontology, Vol. 14, no. 51, p. 32, 1927. Cushman, Jour. Pal., Vol. 1, p. 167, pl. 26, fig. 13, 1927. Cole, Bull. Am. Paleontology, Vol. 14, no. 63, p. 216 (16), 1928. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 49, pl. 20, figs. 12a, b, 1935.

This form is small, subglobose, with broadly rounded periphery. The gently curved sutures are distinct but not depressed. Specimens obtained in Scott County ranged from the Moodys Branch member of the Jackson to the top of the Yazoo clay.

CASSIDULINA WINNIANA Howe

Plate IX, 5

Cassidulina winniana Howe, La. Dept. Cons. Geol. Bull. 14, p. 82, pl. 11, figs. 7, 8, 1939.

"Test minute, consisting of subglobular chambers, nine chambers being visible from either side; periphery strongly lobulated; chambers very distinct, inflated, in alternating pairs at each side at the periphery; sutures deeply depressed, distinct; wall smooth; aperture an arched slit in the line of coiling. Holotype breadth 0.11 mm.; thickness 0.08 mm."

Specimens of a minute form with deep sutures and eight or nine subglobular chambers in the last whorl are common in the finer screenings of lower Yazoo clay and Moodys Branch marl from Scott County. These forms appear to belong to the species described from the Cook Mountain formation of Louisiana.

Genus CASSIDULINOIDES Cushman, 1927

CASSIDULINOIDES BRAZILIENSIS (Cushman)

Plate IX, 9, 10, 15, 16

Cassidulina braziliensis Cushman, U. S. Nat. Mus., Bull. 104, pt. 3, p. 130, pl. 25, figs. 4, 5, 1922.

Cassidulinoides braziliensis (Cushman), Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 72, pl. 10, figs. 6a, b, 1932.

Most specimens are like those illustrated by Howe from Danville Landing, Louisiana, but variations of tests exhibit all stages from a compact type to those that show marked elongation and curvature like the featured specimens. These latter may merit assignment to a new variety.

This form is fairly common in the fine material of the samples studied and appears to range throughout the Jackson formation.

FAMILY CHILOSTOMELLIDAE

Genus CHILOSTOMELLA Reuss, 1850

CHILOSTOMELLA CYLINDROIDES Reuss

Plate IX, 33

Chilostomella cylindroides Reuss, Zeitschr. deutsch. geol. Ges., Vol. 3, p. 60, pl. 6, fig. 43, 1851. Bornemann, l.c., Vol. 7, p. 343, pl. 17, fig. 1, 1855. Hantken, Mitth. Jahrb. ungar. geol. Anstalt., Vol. 4, p. 63, pl. 7, fig. 7, (1881). Cushman, in Contr. Cushman Lab. Foram. Res., Vol. 1, pt. 4, p. 76, pl. 11, figs. 14a-c, 15a-d, 1926. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 72, pl. 14, figs. 1a, b, 1932.

A few specimens which belong to this small species came from a sample from the uppermost portion of the Yazoo clay from a test hole near the county line approximately 4 miles southwest of Morton and from another approximately 3 miles south of Morton.

Genus CHILOSTOMELLOIDES Cushman, 1926

CHILOSTOMELLOIDES OVIFORMIS (Sherborn and Chapman)

Plate IX, 31

Lagena (Obliquina) oviformis Sherborn and Chapman, Jour. Roy. Mic. Soc., p. 745, pl. 14, figs. 19a-d, 1886.

Chilostomella oviformis Sherborn and Chapman, Jour. Roy. Mic. Soc., p. 485, pl. 11, fig. 13, 1899.

Chilostomelloides oviformis Cushman, in Contr. Cushman Lab. Foram. Res., Vol. 1, pt. 4, p. 77, pl. 11, figs. 17a-d, 21a-c, 1926. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 73, pl. 15, fig. 5, 1932.

"Test oval in front view, ends broadly rounded; wall smooth; aperture circular or nearly so, standing out at a distinct angle from the general contour of the test, with a thickened lip."

Two specimens were obtained from the sample of upper Yazoo clay which yielded *Chilostomella cylindroides* Reuss.

Genus PULLENIA Parker and Jones, 1862

PULLENIA QUINQUELOBA (Reuss)

Plate IX, 8

Nonionina quinqueloba Reuss, Deutsch. Geol. Gesell. Zeit., Vol. 3, p. 71, pl. 5, fig. 31, 1851.

Pullenia quinqueloba Cushman, U. S. Nat. Mus., Bull. 104, pt. 5, p. 42, pl. 8, figs. 5-9, 11, 1924. Plummer, Univ. Texas Bull. 2644, p. 136, pl. 8, figs. 12a, b, 1927. Nuttall, Jour. Pal., Vol. 4, p. 289, 1930. Cushman, Contr. Cushman Lab. Foram. Res., Vol. 16, p. 72, pl. 12, figs. 13, 14, 1940. Toulmin, Jour. Pal., Vol. 15, no. 6, p. 607, pl. 81, fig. 24, 1941.

"Test planispiral, completely involute, bilaterally symmetrical, somewhat compressed, periphery rounded, slightly lobate; chambers four or five in the final whorl, increasing regularly in size as added; sutures distinct, straight, slightly depressed; wall smooth, polished; aperture a highly arched slit across the periphery at the base of the final chamber. Diameter 0.24-0.42 mm.; thickness up to 0.26 mm."

The species ranges sparingly through the Jackson formation and was found in several of the Scott County samples.

FAMILY GLOBIGERINIDAE

Genus GLOBIGERINA d'Orbigny, 1826

GLOBIGERINA BULLOIDES d'Orbigny

Globigerina bulloides d'Orbigny, Ann. Sci. Nat., Vol. 7, no. 1, Modeles, Nos. 17 and 76, p. 227, 1826. Cushman, U. S. Nat. Mus., Bull. 71, pt. IV, p. 5, pl. 5, figs. 7-9, 1914. (Lists numerous references). Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 73, pl. 10, fig. 10, 1932.

This species ranges through the Jackson formation and was found abundantly in the finer material of most of the samples from Scott County.

GLOBIGERINA DANVILLENSIS Howe and Wallace

Plate IX, 24, 25

Globigerina danvillensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 74, pl. 10, figs. 9a, b, 1932.

"Test small, trochoid but nearly planispiral, periphery lobate; chambers few, about eight visible on the dorsal side, about four in the last-formed whorl, almost spherical in shape; sutures depressed; wall calcareous, finely spinose, perforate; aperture an almost circular opening on the ventral side not quite centered on the periphery. Diameter 0.2 mm.; diameter of largest chamber 0.13 mm."

Small tests which belong to this species are common in the fine screenings of most Jackson samples from Scott County.

GLOBIGERINA sp. (A) Howe and Wallace

Globigerina sp. (A) Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 75, pl. 10, figs. 8a, b, 1932.

"Test small, trochoid with low spire, periphery broadly rounded, lobate; chambers few, about eleven usually present, five making up the last formed coil; sutures distinct, depressed; umbilical area deep; wall calcareous, finely spinose. Diameter 0.19 mm."

One of the samples of lower Yazoo clay from a test hole at Forest furnished a few specimens that appear to be the same as the form described from the beds at Danville Landing, Louisiana, where it is common.

GLOBIGERINA sp. (B) Howe and Wallace

Plate IX, 20, 21, 29, 30

Globigerina sp. (B) Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 75, pl. 10, fig. 5, 1932.

"Test about as long as broad, trochoid with low spire, periphery broadly rounded, lobate; chambers numerous, the principal part of the test consisting of the last four, of these the last is slightly compressed, the other three being almost spherical in shape; sutures distinct, depressed; wall calcareous, coarsely perforate; aperture a large, low-arched opening with a faint lip. Diameter of the last chamber 0.3 mm."

Specimens which seem to compare with this unnamed species, described from the Jackson formation of Louisiana and reported to be common there, were noted in both the lower and upper beds of the Yazoo clay in Scott County.

FAMILY HANTKENINIDAE

Genus HANTKENINA Cushman, 1924

HANTKENINA ALABAMENSIS Cushman

Plate X, 2, 4

Hantkenina alabamensis Cushman, U. S. Nat. Mus. Proc., Vol. 66, art. 3, p. 3, pl. 1, figs. 1-6, pl. 2, fig. 5, 1924; Contr. Cushman Lab. Foram. Res., Vol. 1, pp. 7, 68, pl. 1, fig. 11, 1925. Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 177, pl. 10, fig. 3, 1926. Cushman, Jour. Pal., Vol. 1, p. 160, pl. 25, fig. 17, 1927. Howe, l.c., Vol. 2, p. 14, text fig. 1, 1928. Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 54, pl. 10, fig. 3, 1932. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 6, fig. 5, 1933. Howe and Wallace, Jour. Pal., Vol. 8, p. 35, pl. 5, fig. 13, 1934. Hadley, Bull. Am. Paleontology, Vol. 20, no. 70A, p. 15, pl. 2, fig. 4, 1934. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 49, pl. 13, figs. 1-5, 1935. Coryell and Embich, Jour. Pal., Vol. 11, p. 299, pl. 43, fig. 10, 1937. Bermudez, Mem. Soc. Cubana Hist. Nat., Vol. 12, p. 13, 1938. Cushman, Contr. Cushman Lab. Foram. Res., Vol. 15, pt. 3, p. 74, pl. 12, fig. 18, 1939.

Specimens show variation in length of spines and in the size, shape, and amount of inflation of chambers. Young specimens in the finer material exhibit a solitary spine on the last formed chamber.

The Scott County samples furnished abundant specimens which are very common in the Yazoo clay.

HANTKENINA DANVILLENSIS Howe and Wallace

Plate X, 1a, b

Hantkenina danvillensis Howe and Wallace, Jour. Pal., Vol. 8, p. 37, pl. 5, figs. 14, 17, 1934.

"Test planispiral, bilaterally symmetrical; periphery lobate; chambers inflated, five in the last coil, each provided with a long hollow spine, located on the periphery near the contact with the next younger chamber; wall smooth, calcareous, finely perforate; aperture an elliptical opening at the base of the last chamber, above which is an elaborate supplementary apertural plate out of which extend four tubular openings which are round or elliptical in shape. Diameter without spines, 0.55 mm."

Specimens identified as belonging to this species have three to five tubular openings on the apertural plate. All came from lower Yazoo clay samples obtained from test holes in the southeastern part of the county. The form is very rare.

FAMILY GLOBOROTALIIDAE

Genus GLOBOROTALIA Cushman, 1927

GLOBOROTALIA CENTRALIS Cushman and Bermudez

Plate IX, 34, 36, 37

Globorotalia centralis Cushman and Bermudez, Contr. Cushman Lab. Foram. Res., Vol. 13, pt. 1, p. 26, pl. 2, figs. 62-65, 1937. Howe, La. Dept. Cons. Geol. Bull. 14, p. 84, pl. 12, figs. 4-6, 1939.

"Test unequally biconvex, dorsal side only slightly so, ventrally very strongly convex, periphery rounded; chambers few, about 4 in the adult whorl, inflated, increasing rapidly in size as added; sutures distinct, depressed, on the dorsal side strongly oblique, gently curved or nearly straight, ventrally radial; wall smooth, distinctly perforate; aperture an elongate, low, arched opening about midway of the ventral side from periphery to umbilicus. Diameter 0.45-0.55 mm.; thickness 0.35-0.45 mm."

Species differs from *G. cocoaensis* Cushman in the more inflated form, more convex ventral side, and more rounded periphery.

Good specimens which compare with those described from Cuba were obtained from lower Yazoo clay samples at two localities in Scott County.

GLOBOROTALIA COCOAENSIS Cushman

Plate IX, 32, 35, 38

Globorotalia cocoaensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 4, p. 75, pl. 10, figs. 3a-c, 1928. Howe and Wallace, La. Dept. Conservation Geol. Bull. 2, p. 75, pl. 14, fig. 4, 1932. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 4, figs. 6a, b, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 50, pl. 21, figs. 1-3, 1935.

Both small and large specimens of this species are common in the lower Yazoo clay and the Moodys Branch marl of Scott County. This form has been noted in material from Yazoo County, and Cushman records it from a locality 1½ miles south of Shubuta.

FAMILY ANOMALINIDAE

Genus ANOMALINA d'Orbigny, 1826

ANOMALINA BILATERALIS Cushman

Anomalina bilateralis Cushman, U. S. Geol. Survey Prof. Paper 129, pp. 97, 137, pl. 21, figs. 1, 2, 1922; Prof. Paper 133, p. 42, 1923. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 4, fig. 7, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 50, pl. 21, figs. 4, 5, 1935.

"Test of about 4 coils, bilateral or nearly so, composed of numerous chambers, 10 or more in the last-formed whorl, umbilical region on both sides with a knob of clear shell material, more pronounced on the dorsal side; chambers smooth but coarsely punctate, more coarsely so on the ventral side; sutures broad and somewhat limbate with clear shell material; aperture a narrow curved opening at the base of the final chamber. Maximum diameter 1.00 mm."

Specimens are distinguished by the clear shell material in the umbilical region and by the curved limbate sutures. Some of the larger specimens tend to show depressed sutures without clear shell material in the later portion of the test.

This species was found sparingly in some of the samples studied and seems to range through the Jackson. Cushman lists it from several localities in the Jackson of the state.

ANOMALINA COCOAENSIS Cushman

Anomalina cocoaensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 4, p. 75, pl. 10, figs. 4a-c, 1928; U. S. Geol. Survey Prof. Paper 181, p. 51, pl. 21, figs. 13a-c, 1935.

Cushman lists this species from a locality 1½ miles south of Shubuta. It was not observed in the Scott County material.

ANOMALINA COSTIANA Weinzierl and Applin

Plate X, 20, 21

Anomalina costiana Weinzierl and Applin, Jour. Pal., Vol. 3, no. 4, p. 409, pl. 44, figs. 7a-c, 1929.

"Test small, compressed, involute, almost equally biconvex, peripheral margin angled, chambers numerous, 9 or 10 in the last-formed coil, comparatively long and narrow; sutures on the ventral side limbate, slightly raised, extending from the margin to the umbilicus which is covered by a low boss of clear shell material; on the dorsal side, also limbate, extending from the periphery to within a short distance from the inner end of the chamber, where the limbate covering broadens rapidly, is more elevated and ends abruptly. These prominent sutural endings show through the central opening from the earlier whorls and give the center of the test a beaded appearance, which is accentuated by the narrow, smooth band of unornamented material which separates it from the remainder of the test, decorated with the suture lines described above. Mouth opening a narrow slit at the periphery on the last formed chamber."

The species is abundant through the Jackson formation of Scott County.

ANOMALINA GRANOSA (Hantken) var. DIBOLLENSIS Cushman and Applin

Plate X, 3

Anomalina granosa (Hantken) var. *dibollensis* Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 179, pl. 9, fig. 15, 1926. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 50, pl. 21, figs. 6, 7, 1935.

A few specimens referable to this variety were found in upper Yazoo clay samples from Scott County. Cushman reported the variety from a locality 1½ miles south of Shubuta.

ANOMALINA JACKSONENSIS (Cushman and Applin)

Discorbis jacksonensis Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 178, pl. 9, figs. 8, 9, 1926.

Anomalina jacksonensis Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 4, figs. 10a, b, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 51, pl. 21, figs. 8a-c, 1935.

This species is listed by Cushman from the Jackson formation 1½ miles south of Shubuta.

ANOMALINA JACKSONENSIS (Cushman and Applin) var. DIBOLLENSIS (Cushman and Applin)

Discorbis jacksonensis Cushman and Applin var. *dibollensis* Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 178, pl. 9, fig. 10, 1926.

Anomalina jacksonensis (Cushman and Applin) var. *dibollensis* (Cushman and Applin), Cushman, U. S. Geol. Survey Prof. Paper 181, p. 51, pl. 21, fig. 9, 1935.

Cushman lists this species from Jackson and Garlands Creek.

Genus PLANULINA d'Orbigny, 1826

PLANULINA COCOAENSIS Cushman var. COOPERENSIS Cushman

Plate X, 5, 6

Planulina cocoaensis Cushman var. *cooperensis* Cushman, Contr. Cushman Lab. Foram. Res., Vol. 9, p. 20, pl. 2, figs. 12a-c, 1933; U. S. Geol. Survey Prof. Paper 181, p. 52, pl. 22, figs. 8a-c, 1935.

Large specimens of this variety showing 7 to 9 chambers in the last coil were found in a few of the upper Yazoo clay samples from Scott County. The form appears to be relatively rare.

Genus CIBICIDES Montfort, 1808

CIBICIDES AMERICANUS (Cushman) var. ANTIQUUS (Cushman and Applin)

Plate X, 22

Truncatulina americana Cushman var. *antiqua* Cushman and Applin, Bull. Am. Assoc. Petr. Geol., Vol. 10, p. 179, pl. 9, figs. 12, 13, 1926; U. S. Geol. Survey Prof. Paper 181, p. 53, pl. 22, figs. 1, 2, 1935.

A few specimens which may belong to this variety came from lower Jackson samples from Scott County. Cushman lists it at Garlands Creek and Jackson.

CIBICIDES AMERICANUS (Cushman) var. JACKSONENSIS Bergquist, n. var.

Plate X, 17, 18

Test compressed, periphery angled, outline slightly lobulate, ventral side convex, dorsal side flattened or slightly convex; chambers numerous, ten to twelve in last-formed coil, last few failing to meet umbilicus on dorsal side; strongly curved sutures outlined by clear shell material, each thinned at periphery and umbilicus from wide raised arch in middle area; umbilicus on each side filled by boss of shell material; aperture peripheral with a slight lip extending backward along dorsal side for one or two chambers. Length 0.47 mm.; width 0.30 mm.

This form is conspicuous with raised limbate sutures which on large specimens are somewhat sigmoid and closely spaced in middle area. This variety is present in many of the Jackson samples in Scott County. It resembles *C. americanus* var. *crassiseptus* Cushman and Laiming from the Miocene of Los Sauces Creek, Ventura County, California, but the limbate sutures do not fuse at the periphery to form a keel.

Cotypes: Lower Yazoo clay, test hole J89, 1½ miles southeast of Forkville; Type slide X, 17, 18, Mississippi Geological Survey.

CIBICIDES LOBATULUS (Walker and Jacob)

Plate X, 11, 12, 13

Nautilus lobatula Walker and Jacob, Adam's Essays on the microscope, Kanmacher's ed., p. 642, pl. 14, fig. 36, 1798.

Truncatulina lobatula (Walker and Jacob) Cushman, U. S. Geol. Survey, Bull. 676, p. 16, pl. 1, fig. 10; p. 60, pl. 17, figs. 1-3, 1918; Carnegie Inst.

Washington Pub. 291, p. 41, 1919; U. S. Geol. Survey Prof. Paper 129, pp. 96, 135, pl. 20, figs. 1-3, 1923; Prof. Paper 133, p. 40, 1923.

Cibicides lobatulus Cushman, Jour. Pal., Vol. 1, p. 170, pl. 27, figs. 12, 13, 1927. Hanna and Church, Jour. Pal., Vol. 1, p. 201, 1928. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 52, pl. 22, figs. 4-6, 1935.

"Test planoconvex, flattened on the ventral face, moderately convex dorsally or nearly flat, sometimes slightly concave, peripheral margin rounded; chambers numerous, 7 or 8 in the last-formed whorl; sutures depressed, especially on the dorsal face; wall smooth, conspicuously punctate."

This is a highly variable species. Small specimens are nearly circular in outline, but the chambers of larger forms are lobulate along the periphery. On some specimens the dorsal face is very concave or irregular due to attachment during growth. Scott County samples indicate the species is distributed through the Jackson formation.

CIBICIDES LOBATULUS (Walker and Jacob) var. ?

Plate X, 14a, b, 15a, b

A coarsely punctate small form, with strongly lobate chambers and keeled periphery and with sutures limbate on dorsal side and deep ventrally, was fairly common in some of the samples of Moodys Branch material from Scott County test holes. It is provisionally placed as a variety of this highly variable species. Maximum diameter 0.40 mm.; figure 15, length 0.37 mm.; width 0.34 mm.

CIBICIDES MISSISSIPPIENSIS (Cushman)

Plate X, 7a, b, c

Anomalina mississippiensis Cushman, U. S. Geol. Survey Prof. Paper 129, pp. 98, 137, pl. 21, figs. 6-8, 1922; Prof. Paper 133, p. 43, 1923.

Cibicides mississippiensis Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 5, figs. 6, 7, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 54, pl. 22, figs. 3a-c, 1935.

"Test small, planoconvex, of about 2½ coils, periphery slightly lobulate, bluntly rounded, dorsal side very much flattened, even slightly concave, ventral side very convex; chambers comparatively few, 6 to 8 in the last-formed coil; sutures curved, on the dorsal side broad and limbate, even with the surface of clear shell material, on the ventral side narrower and depressed; the last-formed 2 or 3 chambers on the inner margin on the dorsal side slightly above the general surface; wall thin and translucent, especially on the dorsal side, smooth, on the ventral side finely punctate and not so clear; aperture a curved opening at the inner margin at the periphery, extending to the dorsal side. Length 0.25-0.35 mm.; breadth 0.20-0.30 mm."

This species was found in abundance throughout the Jackson formation in Scott County.

CIBICIDES OUACHITAENSIS Howe and Wallace

Plate X, 8, 9

Cibicides ouachitaensis Howe and Wallace, La. Dept. Cons. Geol. Bull. 2, p. 78, pl. 14, figs. 6a-c, 1932.

"Test fairly large for the genus, planoconvex, trochoid, compressed, in outline almost circular, periphery keeled, slightly lobate; chambers numerous, about nine in the last-formed coil, slightly inflated; sutures distinct, depressed, curved, on the dorsal side raised and limbate, except on the last three chambers where the sutures are depressed; umbilical area on the ventral side provided with a small boss; wall calcareous, perforate; aperture a curved slit on the periphery, extending back about two-thirds the length of the chamber on the dorsal side, provided with a small lip; unclosed apertures of the two preceding chambers still present. Diameter 0.75 mm.; thickness 0.2 mm."

Some of the Scott County specimens depart from the near circular outline of the species and show irregularity in the late chambers and even exhibit some flattening in this portion of the test. The dorsal surface of some individuals shows slight concavity. On most specimens the keel is poorly developed.

The specimens are from a test hole in the top of the Yazoo clay 4 miles southwest of Morton.

CIBICIDES PSEUDOUNGERIANUS (Cushman)

Truncatulina ungeriana H. B. Brady, *Challenger* Rept., Zoology, Vol. 9, pl. 94, figs. 9a-c, 1884 (not *Rotalina ungeriana* d'Orbigny). Cushman, U. S. Nat. Mus., Bull. 103, p. 69, pl. 24, fig. 1, 1918.

Truncatulina pseudoungeriana Cushman, U. S. Geol. Survey Prof. Paper 129, pp. 97, 136, pl. 20, fig. 9, 1922; Prof. Paper 133, p. 40, 1923.

Cibicides pseudoungerianus (Cushman), Prof. Paper 181, p. 52, pl. 23, figs. 1a-c, 1935.

Cushman has reported this species from the Jackson formation at Jackson and Garlands Creek. It was not noted in the Scott County samples.

CIBICIDES YAZOOENSIS Cushman

Plate X, 10

Cibicides yazooensis Cushman, Contr. Cushman Lab. Foram. Res., Vol. 7, p. 59, pl. 7, figs. 12a-c, 1931. Ellisor, Bull. Am. Assoc. Petr. Geol., Vol. 17, no. 11, pl. 5, figs. 2, 5, 1933. Cushman, U. S. Geol. Survey Prof. Paper 181, p. 53, pl. 23, figs. 2a-c, 1935.

"Test slightly longer than broad, compressed, periphery angled, slightly lobulate, ventral side convex, dorsal side flattened or slightly convex, nearly involute on both sides; chambers distinct, usually 8 in the last-formed coil; sutures distinct, curved, very strongly limbate and somewhat raised, increasing in thickness toward the inner end; wall distinctly but finely perforate, with a clouding of the surface except at the sutures, which are clear and transparent; aperture a curved, somewhat arched opening near the periphery on the ventral side. Length 0.60 mm.; breadth 0.50 mm.; thickness 0.25 mm."

This species is sparingly present in the lower Yazoo clay in Scott County.

Genus CIBICIDELLA Cushman, 1927

CIBICIDELLA sp.

Plate X, 19

Rare specimens of this genus were found in a few upper Yazoo clay samples. They show a central area similar to *Cibicides lobatulus* bordered by smaller chambers. The apertures on the latter chambers are small and are visible on only a few of the chambers.

FAMILY PLANORBULINIDAE

Genus GYPSINA Carter, 1877

GYPSINA GLOBULA (Reuss) var. ?

Plate X, 16

Ceriopora globulus Reuss, Haidinger's Naturwiss. Abh., Vol. 2, p. 23, pl. 5, fig. 7, 1847.

Gypsina globula (Reuss), Cushman, U. S. Geol. Survey Prof. Paper 181, p. 54, pl. 23, figs. 4, 5, 1935.

"Test globular, usually spherical, consisting of numerous chambers in irregular concentric layers, surface postulose, as all the chambers are not added at the same time, the last-formed chambers protruding beyond earlier-formed ones; wall coarsely perforate, between adjacent chambers somewhat thickened but not raised. Maximum diameter 2.00 mm."

Excellent specimens of spherical shape, like the featured individual, were found in Moodys Branch material from Jackson and in one sample from Yazoo County. The surfaces of most of the specimens examined are strikingly marked by closely spaced coarsely perforate polygonal depressions, separated from one another by a continuous network of slightly elevated shell material. These specimens may represent a new variety. None was noted in the Scott County samples.

DESCRIPTION OF OSTRACODA

FAMILY CYTHERELLIDAE SARS

Genus CYTHERELLA Jones

CYTHERELLA sp.

Plate XI, 1

Cytherella sp., Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 6, pl. 4, figs. 17, 18; pl. 5, figs. 11, 12, 1935.

Specimens of a smooth nearly ovate form are found sparingly throughout the Yazoo clay of Scott County.

Genus CYTHERELLOIDEA Alexander

CYTHERELLOIDEA DANVILLENSIS Howe var.

Plate XI, 2

Cytherelloidea danvillensis Howe, Jour. Pal., Vol. 8, no. 1, p. 31, 1934; Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 6, pl. 5, figs. 5, 6, 1935.

Carapace is small, oblong, subquadrangular with a slightly raised ridge encircling the periphery. Valves are flattened, and a prominent pit below center of dorsal margin is bounded by a low ridge which is convex upward. A shorter ridge parallels it.

Figured specimen came from test hole J40 in the upper Yazoo clay. It appears to be rare in the Scott County material.

FAMILY CYPRIDAE BAIRD

Genus BYTHOCYPRIS Brady

BYTHOCYPRIS (?) GIBSONENSIS Howe and Chambers

Plate XI, 3

Bythocypris (?) *gibsonensis* Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 9, pl. 3, fig. 10; pl. 4, fig. 3, 1935.

Carapace is smooth, elongate, arched along dorsal margin and convex along ventral margin. This species was found in several of the Scott County samples and ranges throughout the Jackson formation.

Genus PARACYPRIS Sars

PARACYPRIS FRANQUESI Howe and Chambers

Plate XI, 4

Paracypris franquesi Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 10, pl. 3, fig. 13; pl. 4, figs. 15, 19, 1935.

Carapace smooth, elongated, posterior end acutely pointed, anterior end broadly and obliquely rounded. Specimens of this form were obtained only from samples of lower Jackson material in Scott County.

FAMILY CYTHERIDAE BAIRD

Genus CYTHERIDEA Bosquet

CYTHERIDEA MONTGOMERYENSIS Howe and Chambers

Plate XI, 5

Cytheridea montgomeryensis Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 17, pl. 1, fig. 1; pl. 2, figs. 1-3, 7, 9; pl. 6, figs. 17, 18, 1935.

Carapace tumid, subpyiform, ornamented by a few marginal spines at anterior and posterior ends and the surface by pits arranged in curvilinear rows at right angles to the long axis.

The species is common throughout the Yazoo clay in Scott County.

Genus CYTHEROPTERON Sars

CYTHEROPTERON MONTGOMERYENSIS Howe and Chambers

Plate XI, 6

Cytheropteron montgomeryensis Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 19, pl. 3, figs. 14-16; pl. 4, figs. 11, 12, 16, 1935.

Carapace minute, dorsal margin arched, ventral margin gently curved and overhung by prominent alae which are strongly produced and slightly keeled, and each terminated by a blunt spine. Surface with a few round pits in posterior half. Specimens were found sparingly in some of the lower Yazoo clay samples from Scott County.

Genus CYTHEREIS Jones

CYTHEREIS BROUSSARDI Howe and Chambers

Plate XI, 7

Cythereis broussardi Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 24, pl. 1, fig. 12; pl. 4, fig. 6, 1935.

The figured specimen represents the only valve of this species that was found in the Scott County samples. It came from test hole J89 in the lower Jackson.

CYTHEREIS FLORIENENSIS Howe and Chambers

Plate XI, 8

Cythereis florienensis Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, pl. 1, fig. 14; pl. 6, figs. 14, 15, 1935.

The carapace of this species is coarsely reticulate with some of the reticulations forming low spines; five spines are along the dorsal margin. Specimens are rare, those found came from samples of lower Yazoo clay from test holes J89 and J162C.

CYTHEREIS GIBSONENSIS Howe and Chambers

Plate XI, 9, 10

Cythereis gibsonensis Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, pl. 1, fig. 22; pl. 6, figs. 21, 22, 1935.

Carapace elongated with rounded anterior end bearing a double row of spines, posterior end pointed and coarsely spinose; two irregular rows of spines are present on the surface of the carapace. Specimens were not common, but those obtained came from test hole J89 in the lower part of the formation and from test hole J40 in the upper Yazoo clay.

CYTHEREIS HYSONENSIS Howe and Chambers var. DOHMI Howe and Chambers

Plate XI, 11

Cythereis hysonensis Howe and Chambers var. *dohmi* Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, pl. 1, fig. 9, 1935.

Carapace small, subrectangular, dorsal and ventral margins straight but converge slightly toward the posterior end which bears a few spines. Surface smooth with a ridge parallel to ventral margin terminating in a spine in the posterior third of the carapace where it connects by a short vertical ridge with a dorsal ridge also ending in a spine posteriorly.

Specimens were found rarely in Moodys Branch material and basal Yazoo clay in test holes J84 and J89 respectively.

CYTHEREIS (?) ISRAELSKYI Howe and Pyeatt

Plate XI, 12

Cythereis (?) israelskyi Howe and Pyeatt, Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 33, pl. 1, figs. 19-21; pl. 4, figs. 7-9, 1935.

Carapace minute, highest in front of middle, anterior end broadly rounded, posterior end somewhat acute. Surface marked by strong longitudinal ribs on posterior half of shell, anterior half coarsely and irregularly perforate.

This small form is present in several of the Scott County samples and ranges throughout the Yazoo clay.

CYTHEREIS (?) ISRAELSKYI Howe and Pyeatt var. MORSEI Howe and Pyeatt

Plate XI, 13

Cytheris (?) israelskyi Howe and Pyeatt var. *morsei* Howe and Pyeatt, Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 34, pl. 3, figs. 11, 12, 1935.

Variety is strongly pitted over entire surface of carapace. A few specimens were found in basal Yazoo clay in test hole J84.

CYTHEREIS (?) ISRAELSKYI Howe and Pyeatt var. WARNERI Howe and Pyeatt

Cythereis (?) *israelskyi* Howe and Pyeatt var. *warneri* Howe and Pyeatt, Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 35, pl. 3, fig. 8, 1935.

This unornamented form is reported to be very common in the upper Jackson and rather rare in the lower part of the formation. Only one specimen which seems to belong to this variety was noted in the Scott County material. It came from test hole J40 in the upper part of the formation.

CYTHEREIS (?) JACKSONENSIS Howe and Pyeatt

Plate XI, 14

Cythereis (?) jacksonensis Howe and Pyeatt, La. Dept. Cons. Geol. Bull. 5, p. 35, pl. 1, figs. 23, 24; pl. 6, fig. 31, 1935.

The figured specimen is a form having a reticulated ridged surface with low pits and spine. It was noted only in the lower Yazoo clay in test hole J86.

CYTHEREIS MONTGOMERYENSIS Howe and Chambers

Plate XI, 15, 16

Cythereis montgomeryensis Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 37, pl. 1, figs. 13, 16; pl. 2, figs. 22, 23; pl. 6, figs. 19, 20, 1935.

This form is an elongate spinose species that ranges throughout the Yazoo clay of Scott County.

CYTHEREIS YAZOOENSIS Howe and Chambers

Plate XI, 17

Cythereis yazooensis Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 38, pl. 1, fig. 6; pl. 6, figs. 29, 30, 1935.

Carapace small, delicate, transparent, anterior end broadly rounded with 8 or 9 compressed T-shaped spines. A few spines are present along the other margins. This little form is represented in the Scott County material only by the figured specimen which came from test hole J1A at Forest.

Genus LOXOCONCHA Sars

LOXOCONCHA JACKSONENSIS Howe and Chambers

Plate XI, 18

Loxoconcha jacksonensis Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 41, pl. 4, fig. 20; pl. 5, fig. 14; pl. 6, figs. 8, 9, 1935.

The form is small, subovate in side view with the surface minutely pitted. A number of specimens were found in lower Jackson material from Scott County test holes.

Genus CYTHEROMORPHA Hirschmann

CYTHEROMORPHA OUACHITAENSIS Howe and Chambers

Plate XI, 19

Cytheromorpha ouachitaensis Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 44, pl. 5, fig. 8; pl. 6, figs. 4, 5, 1935.

Carapace narrow, elongate ovate, surface ornamented by rows of small pits, or nearly smooth. The specimen figured came from the lower Yazoo clay from test hole J86.

Genus CYTHERETTA Muller

CYTHERETTA ALEXANDERI Howe and Chambers

Plate XI, 20

Cytheretta alexanderi Howe and Chambers, La. Dept. Cons. Geol. Bull. 5, p. 45, pl. 5, figs. 17-21; pl. 6, figs. 27, 28, 1935.

This species, ornamented by longitudinal ribs, was found in two upper Yazoo clay test holes, J42 and J27, and in the lower Yazoo clay in test hole J86.

Genus BRACHYCYTHERE Alexander

BRACHYCYTHERE WATERVALLEYENSIS Howe and Chambers

Plate XI, 21, 22

Brachycythere watervalleyensis Howe and Chambers, La. Dept. Cons. Geol. Bull 5, p. 46, pl. 3, figs. 1-6; pl. 4, fig. 1; pl. 6, fig. 7, 1935.

This form is rather characteristically shaped with pronounced alae that are terminated by spines on the males. The carapace is smooth but slightly punctate. All specimens obtained from the Scott County material came from test holes in the lower portion of the Yazoo clay.

TEST HOLE LOCALITIES OF FIGURED SPECIMENS WITH BRIEF DESCRIPTIVE LOGS

J1A Peavy property (NE.1/4, SW.1/4, NE.1/4, Sec.15, T.6 N., R.8 E.) East edge of corporate limits of Forest, 100 feet south of U. S. Highway 80

	Feet
Alluvial sandy clay	9.2
Yazoo clay (lower beds)	
Clay, fossiliferous silty to smooth light-tan; slightly gypsiferous in lower part S3 to S5	18.7
	27.9

J27 U. S. Gov't. property (SW.1/4, SE.1/4, SE.1/4, Sec.15, T.5 N., R.6 E.) Beside fence on north side of roadcut, 100 yards from road corner

	Feet
Alluvial silt and fine-grained sand, clay laminae	12.4
Yazoo clay (upper beds)	
Clay, fossiliferous greenish-gray; weathered tan in upper 2 feet, P2.	12.6
	25.0

J32 R. M. Mize property (SW.1/4, SE.1/4, SW.1/4, Sec.31, T.5 N., R.6 E.) Beside pine tree 50 yards north of road at a point 1/4 mile east of Rankin County line

	Feet
Forest Hill colluvial sand, clay, and silt	11.2
Forest Hill clay, silt, and sand	27.5
Yazoo clay (top)	
Clay, slightly silty plastic greenish-gray, C2	5.5
	44.2

J38 B. R. Rogers property (SW.1/4, SE.1/4, SW.1/4, Sec.5, T.5 N., R.6 E.) In small gully, 10 feet east of road and 100 yards south of bridge over Line Creek

	Feet
Alluvial sand	1.2
Yazoo clay (upper beds)	
Clay, smooth to silty tan, S1	10.8
Clay, fossiliferous and gypsiferous greenish-gray, C2 to C4	34.5
	46.5

J40 W. C. Cooper property (NE.1/4, SW.1/4, NW.1/4, Sec.12, T.5 N., R.6 E.) Location 30 yards north of road, approximately 1/2 mile northwest of Stage road junction

	Feet
Alluvial fine-grained sand	11.8
Yazoo clay (upper beds)	
Clay, fossiliferous silty light-gray and tan, S1	3.5
Clay, fossiliferous and gypsiferous greenish-gray, C1	2.6
	17.9

J42 Tip Stuart property (NW.1/4, NW.1/4, SW.1/4, Sec.6, T.5 N., R.5 E.) In old roadbed 150 yards east of house and 10 yards northwest of road

	Feet
Alluvial sand	4.8
Yazoo clay (upper beds)	
Clay, fossiliferous and somewhat gypsiferous grayish-tan, C1	9.8
Clay, fossiliferous and pyritiferous silty gray, C2	10.0
	24.6

J43 J. P. Donald property (NW.1/4, SE.1/4, NE.1/4, Sec.35, T.6 N., R.6 E.) West side of creek, 10 yards north of road and approximately 100 yards east of house

	Feet
Alluvial clay and sand	9.4
Yazoo clay (upper beds)	
Clay, slightly fossiliferous light-tan, S5	10.1
Clay, fossiliferous and pyritiferous dark greenish-gray, S6	3.5
	23.0

J48 Jim Meassell property (NE.1/4, SE.1/4, SW.1/4, Sec.7, T.7 N., R.6 E.) In grove 50 yards east of road and approximately 1/2 mile northwest of Meassell's store

	Feet
Alluvial sand	8.2
Yazoo clay (fossiliferous basal beds)	
Clay, silty tan mottled gray and brown	5.6
Clay, light-tan	13.3
Clay, gray to greenish-gray; silty in upper part and glauconitic in lower portion, S4	31.2
	58.3

J53 W. R. and C. M. Fairchild property (N. edge of NE.1/4, NE.1/4, NW.1/4, Sec.4, T.7 N., R.6 E.) Beside large gum tree 10 feet south of road and 100 feet east of bridge over Coffee Bogue

	Feet
Alluvial sand	18.2
Moodys Branch marl member	
Sand, fossiliferous fine-grained glauconitic greenish-brown, S3	3.2
Sand, fossiliferous fine-grained glauconitic greenish-gray, S4	3.4
Sand, fossiliferous fine-grained to silty somewhat glauconitic dark gray; pyritic, micaceous lignitic layers in lower part, S5	4.2
Yegua silt	10.4
	39.4

J57 U. S. Gov't. property (SE.1/4, NE.1/4, NE.1/4, Sec.3, T.6 N., R.7 E.) 300 yards south of crossroads and 10 yards west of N-S road

	Feet
Yazoo clay (basal)	
Clay, silty light-tan brown streaked; ferruginous and lime concretions	8.5
Clay, silty light-tan brown streaked; gypsiferous and fossiliferous in lower part, C2 to C5	19.1

Clay, fossiliferous smooth to silty slightly pyritiferous and gypsiferous greenish-gray, C6	14.4
Moodys Branch marl member (?)	
Clay, glauconitic silty greenish-gray; indurated at top, S2, S3	3.7
	45.7

J59 Mrs. J. M. Bates property (SE.1/4, NE.1/4, SE.1/4, Sec.19, T.7 N., R.6 E.) 50 yards west of road and 0.2 mile north of road fork

	Feet
Alluvial sand and clay	2.8
Yazoo clay (middle ? portion)	
Clay, silty tan and gray	8.2
Clay, fossiliferous light-tan; gypsiferous streaks in lower 4 feet, S4, S5	16.4
Clay, fossiliferous greenish-gray, pyritic in lower 10 feet, S6	22.1
	49.5

J73 W. M. Walker property (SE.1/4, NE.1/4, SW.1/4, Sec.35, T.8 N., R.6 E.) Base of large oak near corner of pasture northwest of junction of unimproved road and county highway

	Feet
Yazoo clay (basal beds)	
Clay, silty to arenaceous tan mottled brown; concretions of lime and siderite in basal foot	4.6
Sand, dark concretionary; minor arenaceous tan clay mottlings	4.2
Clay, fossiliferous brown; streaked by lime layers	1.8
Moodys Branch marl member	
Clay, fossiliferous glauconitic, arenaceous light-tan, S3	2.0
Marl, very fossiliferous glauconitic gray to green, S4	2.5
Sand, fossiliferous fine-grained glauconitic gray to green, S5	12.5
Yegua fine-grained lignitic sand	4.4
	32.0

J84 Wm. Coward property (SW.1/4, SE.1/4, NE.1/4, Sec.30, T.8 N., R.6 E.) In woods, 10 feet north of road at a point approximately 1/4 mile southwest of Coward home

	Feet
Yazoo clay (basal)	
Clay, silty tan mottled brown; scattered lime nodules in lower 4 feet	7.8
Clay, slightly fossiliferous silty brown; gray and black streaked; some chalky lime streaks	4.2
Clay, fossiliferous silty tan brown streaked, C2	14.6
Moodys Branch marl member	
Clay, fossiliferous glauconitic greenish-gray, C3	3.4
	30.0

J85 Casper Ueltchey property (SW.1/4, NW.1/4, NE.1/4, Sec.11, T.5 N., R.6 E.) In gully on hillside 200 yards southwest of Ueltchey home

	Feet
Alluvial sand	2.0
Yazoo clay (upper beds)	
Clay, fossiliferous and somewhat gypsiferous smooth tannish-gray brown streaked, S2	16.6
Clay, fossiliferous and somewhat pyritiferous smooth greenish-gray, S3	20.8
	39.4

J86 U. S. Gov't. property (NW.1/4, NW.1/4, NW.1/4, Sec.25, T.8 N., R.6 E.) 30 feet west of road at a point 1/4 mile south of Forkville fire tower

	Feet
Yazoo clay (Lower beds)	
Clay, silty tan brown streaked	6.5
Clay, fossiliferous dark-brown; chalky streaks	4.0
Clay, fossiliferous grayish-tan; chalky lime and brown streaks, S4	13.8
Clay, fossiliferous somewhat pyritiferous greenish-gray; glauconitic in lower part, S5	25.2
Moodys Branch marl member	
Clay and calcareous silt, fossiliferous greenish-gray	4.5
Greensand marl, fossiliferous glauconitic; lignitic in basal 2 feet, S7	13.0
	67.0

J89 R. C. Baker property (near edge of NE.1/4, SE.1/4, NE.1/4, Sec.23, T.7 N., R.6 E.) On slope north of barn, 20 feet east of fence and 75 yards northwest of house. *Ostrea trigonalis* bed 3 feet above hole

	Feet
Yazoo clay (lower beds)	
Clay, fossiliferous light-tan, S1	6.2
Clay, highly fossiliferous crumbly greenish-gray, S2	27.3
Moodys Branch marl member	
Clay, fossiliferous, glauconitic, S2G	5.0
	38.5

J91 Will Miles property (W. edge SW.1/4, NW.1/4, SW.1/4, Sec.16, T.5 N., R.7 E.) In gully on hillside north of road, 1/4 mile east of Robinson Creek

	Feet
Alluvial fine sand and clay	4.5
Yazoo clay (upper ? portion)	
Clay, fossiliferous and gypsiferous tan brown mottled, C2	24.3
Clay, fossiliferous smooth greenish-gray, C3	6.0
	34.8

J162B H. W. Brooks and Sons property (NW.1/4, NW.1/4, SW.1/4, Sec.35, T.6 N., R.9 E.) Beside pine tree on north slope of Bald Hill, 26 feet below summit

	Feet
Yazoo clay	
Clay, fossiliferous and gypsiferous grayish-tan brown streaked, S2	26.7
Clay, highly fossiliferous stiff greenish-gray, S3	29.8
	56.5

J162C H. W. Brooks and Sons property (SW.1/4, SW.1/4, NW.1/4, Sec.35, T.6 N., R.9 E.) Beside gully west of branch near base of Bald Hill, 66 feet below top and 1/4 mile north of road

	Feet
Yazoo clay colluvium	
Clay, fossiliferous arenaceous tan to gray	4.6
Yazoo clay (lower beds)	
Clay, fossiliferous and gypsiferous silty dark-gray to brown	4.1
Clay, fossiliferous and gypsiferous light-tan brown streaked, S3	23.5
Clay, fossiliferous greenish-gray, S4	36.3
	68.5

J164 C. Jones property (SE.1/4, SW.1/4, SE.1/4, Sec.15 T.5 N., R.9 E.) In grove 50 feet west of road and 50 yards northwest of road fork at a point 1 mile east of Sherman Hill church

	Feet
Yazoo clay (lower beds ?)	
Clay, silty tan and gray brown streaked; ferruginous nodules.....	6.8
Clay, fossiliferous ocherous tan brown streaked..................	5.2
Clay, fossiliferous and gypsiferous grayish-tan brown mottled, S4..	14.0
Clay, fossiliferous greenish-gray, C5	16.0
	42.0

J165 S. E. Lackey Lumber Co. property (SE.1/4, NW.1/4, SW.1/4, Sec.34, T.6 N., R.9 E.) 20 feet north of road and opposite deep gully at a point 1 mile west of Bald Hill

	Feet
Yazoo clay (middle ? beds)	
Clay, sparingly fossiliferous tan mottled reddish-brown; scattered concretions of lime and siderite	7.2
Clay, fossiliferous and gypsiferous dark-tan to grayish-tan brown streaked, S3..	20.8
Clay, fossiliferous and pyritiferous dark slate-gray; calcareous silt streaks below 50 feet, S4	57.5
	85.5

J177 Felix A. Scales property (NW.1/4, SW.1/4, NW.1/4, Sec.4, T.5 N., R.6 E.) On hill slope west of wagon road

	Feet
Forest Hill colluvial sandy clay	8.0
Yazoo clay (upper beds)	
Clay, fossiliferous and gypsiferous tan, S3	18.8
Clay, fossiliferous and pyritiferous greenish-gray, S4	1.2
	28.0

J186 (SE.1/4, NW.1/4, SE.1/4, Sec.28, T.6 N., R.6 E.) On south side of secondary road at a point 1 mile west of Ridge Road

	Feet
Forest Hill (?) formation	
Sand, fine-grained to silty gray and tan; streaks of tan silty clay..	12.8
Clay, silty brown yellow streaked	5.1
Yazoo clay (top)	
Bentonite, silty grayish-tan	0.3
Clay, fossiliferous and pyritiferous gray, S2.....................	5.8
	24.0

J188 Henry Risher property (SW.1/4, SE.1/4, NE.1/4, Sec.34, T.6 N., R.7 E.) By large oak 30 feet west of road, 25 feet below hill top

	Feet
Colluvial terrace	
Sand, fine-grained yellow and red to gray; silty clay layers and scattered quartz pebbles	15.5
Yazoo clay (middle ? beds)	
Clay, fossiliferous and gypsiferous grayish-tan brown mottled.....	8.5
Clay, fossiliferous and pyritiferous greenish-gray, S2	1.0
	25.0

J191 Noval James property (SW.1/4, NW.1/4, SE.1/4, Sec.27, T.7 N., R.7 E.) By abandoned road bend west of bridge 1-1/2 miles north of Sparkville

	Feet
Alluvial clay, grayish-tan and brown; scattered quartz pebbles	4.2
Yazoo clay (basal beds)	
Clay, tan brown mottled	9.3
Clay, fossiliferous creamy-tan brown mottled	12.0
Clay, fossiliferous greenish-gray, S5	9.7
Moodys Branch marl member	
Clay-marl, fossiliferous, pyritiferous and glauconitic; grading to sand, S6	12.3
Sand, fossiliferous fine-grained glauconitic and pyritiferous dark gray-green, S7	2.7
Yegua fine-grained argillaceous and pyritiferous greenish-gray sand; streaks of lignite and lignitic clay	7.3
	57.5

J193 Jack Armstrong property (NE.1/4, SW.1/4, Sec.28, T.8 N., R.6 E.) 60 feet west of highway and 25 feet south of tenant house north of Armstrong home

	Feet
Alluvial silty to arenaceous tan and brown clay	12.0
Yazoo clay (basal)	
Clay, fossiliferous and glauconitic mealy silty tan	4.8
Moodys Branch marl member	
Silt, fossiliferous glauconitic gray, S3	3.8
Sand, fossiliferous pyritiferous and glauconitic fine-grained greenish-gray, S4	13.0
Sand, fine-grained glauconitic; interbedded with black lignitic silt, S5	4.0
Yegua silt and fine-grained micaceous and lignitic sand	1.4
	39.0

J211 Jake Picket property (SW.1/4, SW.1/4, SE.1/4, Sec.29, T.6 N., R.6 E.) On west hill slope, 20 yards south of road and about 75 yards northeast on road Y

	Feet
Forest Hill sandy gray and yellow clay	10.0
Yazoo clay	
Clay, fossiliferous and gypsiferous smooth grayish-tan, S2	13.4
Clay, fossiliferous and pyritiferous greenish-gray; streaks of tan	4.2
	27.6

J212 M. S. Myers property (NE. cor., NE.1/4, NW.1/4, NW.1/4, Sec.32, T.6 N., R.6 E.) Near mid-line on west hill slope at a point 150 yards south of Myers home

	Feet
Forest Hill fine-grained tan and gray sand grading to bluish-gray	11.5
Yazoo clay (top)	
Clay, grayish-tan yellow streaked; thin streaks of gray and tan sand	7.5
Clay, fossiliferous gray, S3	2.2
	21.2

J220 (NE.1/4, SE.1/4, NW.1/4, Sec.25, T.6 N., R.6 E.) At intersection of Pulaski and Stage roads

	Feet
Yazoo clay (middle ? beds)	
Clay, grayish-tan brown mottled; patches of small lime concretions	10.5
Clay, fossiliferous and gypsiferous grayish-tan, S3	2.0
	12.5

J226 John McGough property (Center of E. edge, Sec.32, T.6 N., R.7 E.) Hilltop south of road

	Feet
Citronelle (?) fine-grained tan and gray sand	5.6
Yazoo clay (upper beds)	
Clay, fossiliferous and gypsiferous tan brown streaked, S2	17.2
	22.8

J226A North of road; 29.5 feet below J226

	Feet
Yazoo clay	
Clay, grayish-tan brown streaked; scattered lime concretions	6.2
Clay, highly fossiliferous and gypsiferous tan; streaks of sand, S3	13.0
	19.2

J227 Lee Hunter property (SE. cor., Sec.4, T.5 N., R.7 E.) 30 feet west of road at a point 1/4 mile north of road corner

	Feet
Terrace (?) material	
Clay-silt, yellow and gray	10.0
Sand, fine-grained yellow	1.0
Yazoo clay (upper beds)	
Clay, fossiliferous and gypsiferous grayish-tan; lenses of white sand, S3	12.5
	23.5

J228 Craig property (SE.1/4, SW.1/4, SE.1/4, Sec.8, T.5 N., R.7 E.) At edge of field on hill slope east of road bend

	Feet
Terrace colluvial clay	6.0
Yazoo clay (upper beds)	
Clay, fossiliferous grayish-tan red mottled, S3	14.0
	20.0

J233 (SE.1/4, NE.1/4, SW.1/4, Sec. 16, T.5 N., R.7 E.) On north slope of hill 28 feet below road on summit; 100 yards west of cemetery

	Feet
Alluvial sand	1.0
Forest Hill (?) fine-grained tan and gray sand	7.4
Yazoo clay (top ?)	
Clay, silty chocolate-brown; mottled by ocherous yellow silt; silt laminae and *Textularia* imprints	7.6
Clay, fossiliferous and gypsiferous greenish-gray, S4	3.2
	19.2

J241A (Sec.29, T.5 N., R.8 E.) On knoll in pasture north of Boyles home, 1/4 mile northeast of Homewood

	Feet
Yazoo clay (upper beds)	
Clay, silty grayish-tan brown mottled; scattered lime concretions..	6.8
Clay, fossiliferous and gypsiferous grayish-tan, S3	12.2
	19.0

J244 (Sec.32, T.5 N., R.8 E.) One mile southeast of Homewood, 100 yards northeast of house and 10 feet west of road

	Feet
Forest Hill formation	
Sand, fine-grained yellow	4.0
Clay, silty yellow gray and red	4.1
Clay, silty chocolate-brown; laminated with gray silt	3.3
Yazoo clay (top)	
Clay, fossiliferous silty pyritiferous greenish-gray, S4	14.6
	26.0

PLATES AND EXPLANATIONS

DRAWINGS
BY
MARY LOUISE PEGUES

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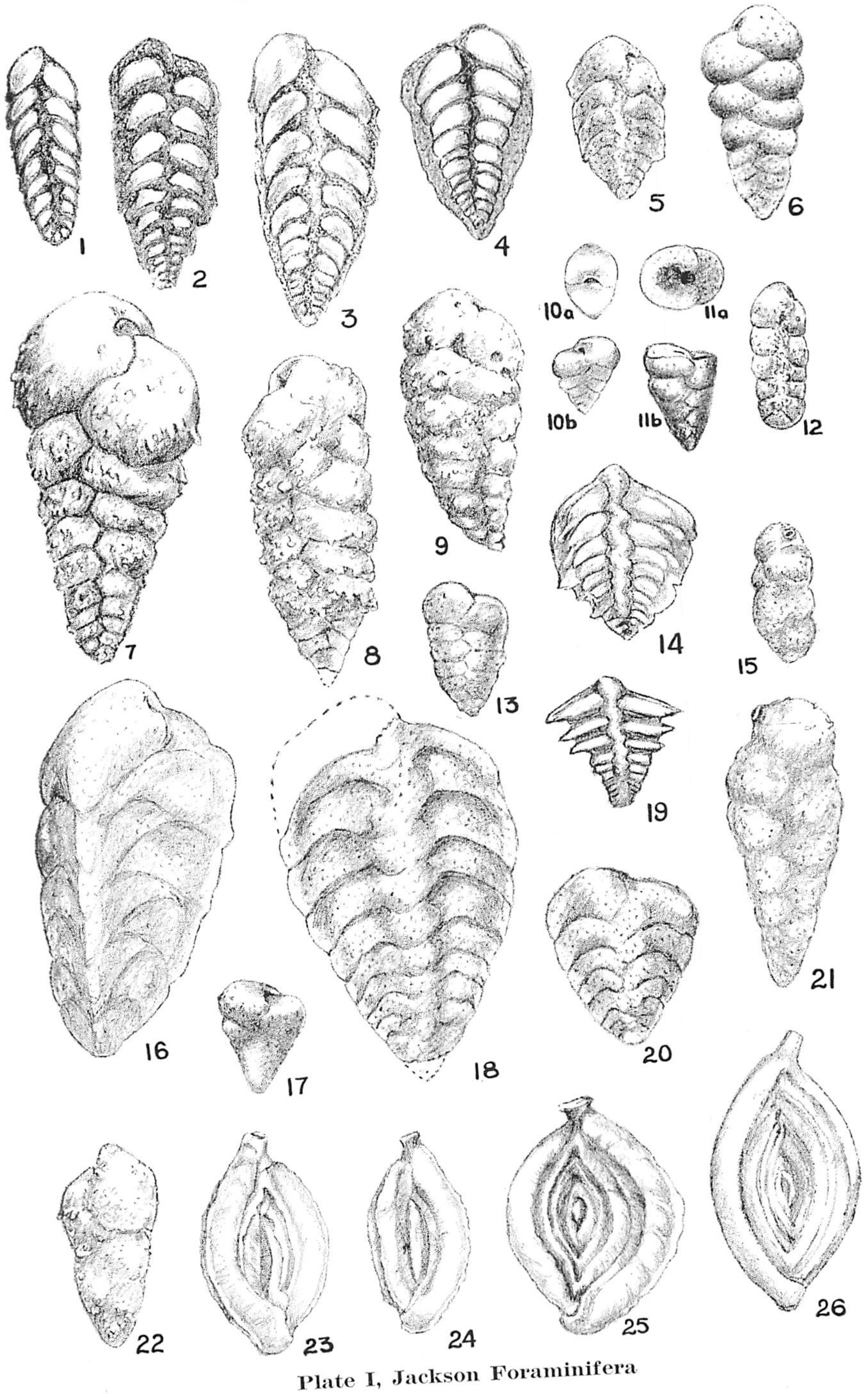

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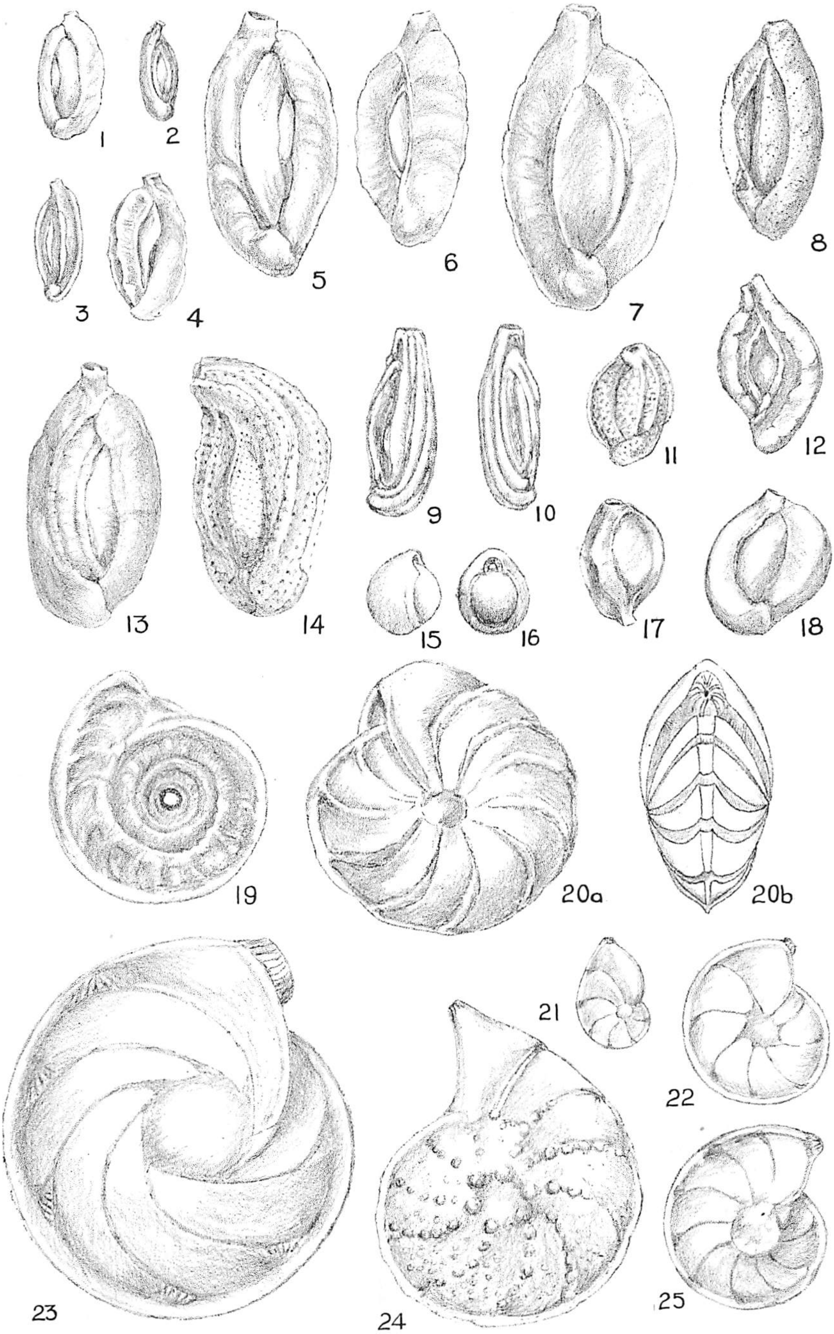

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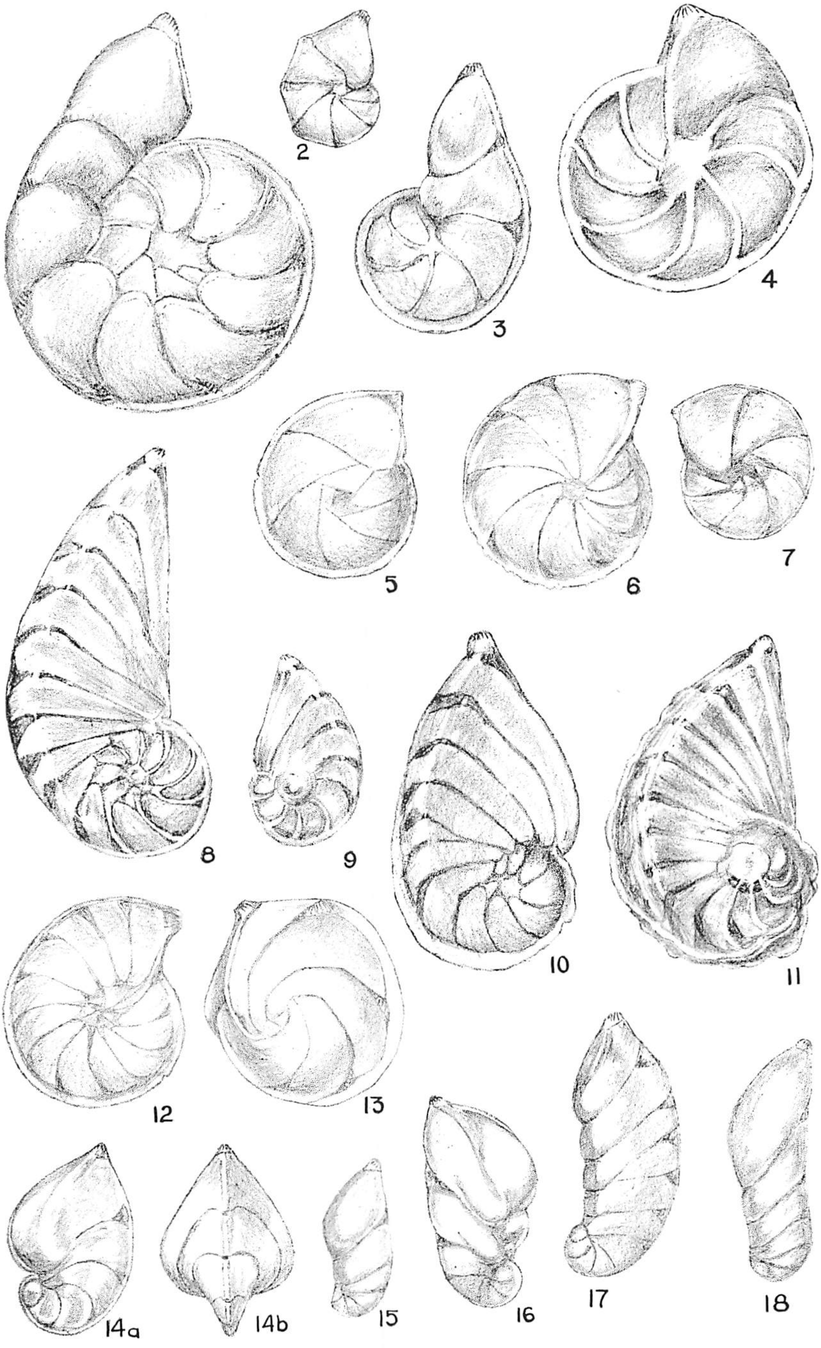

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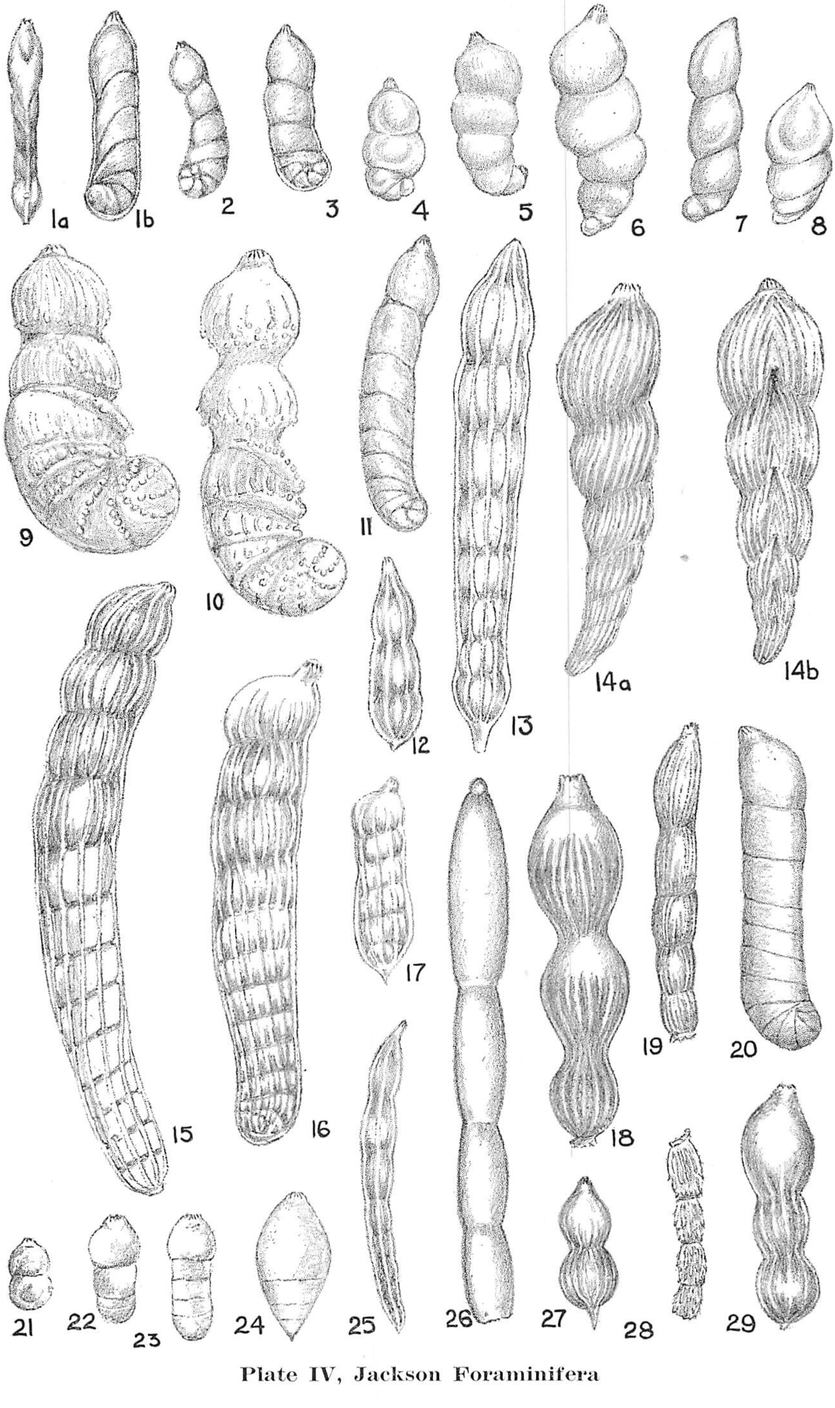

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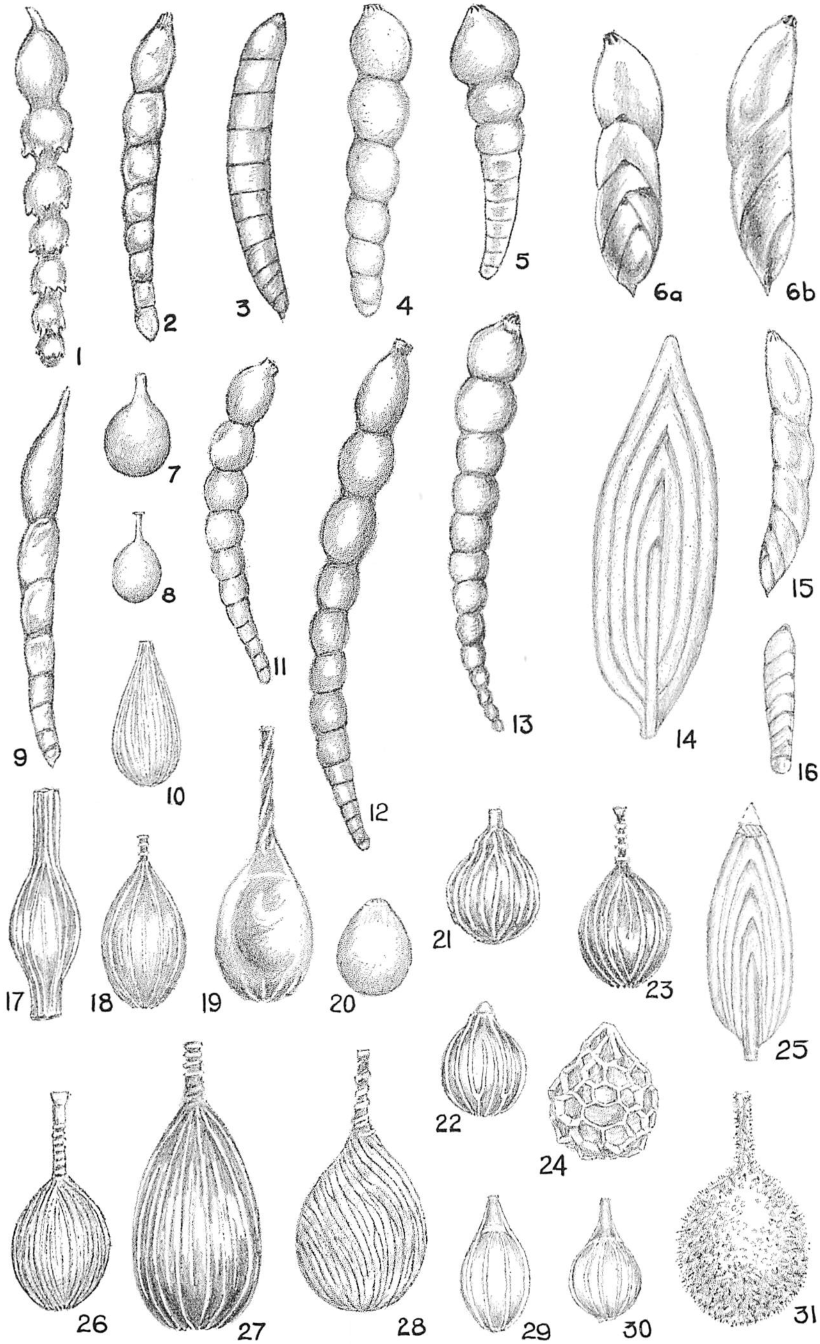

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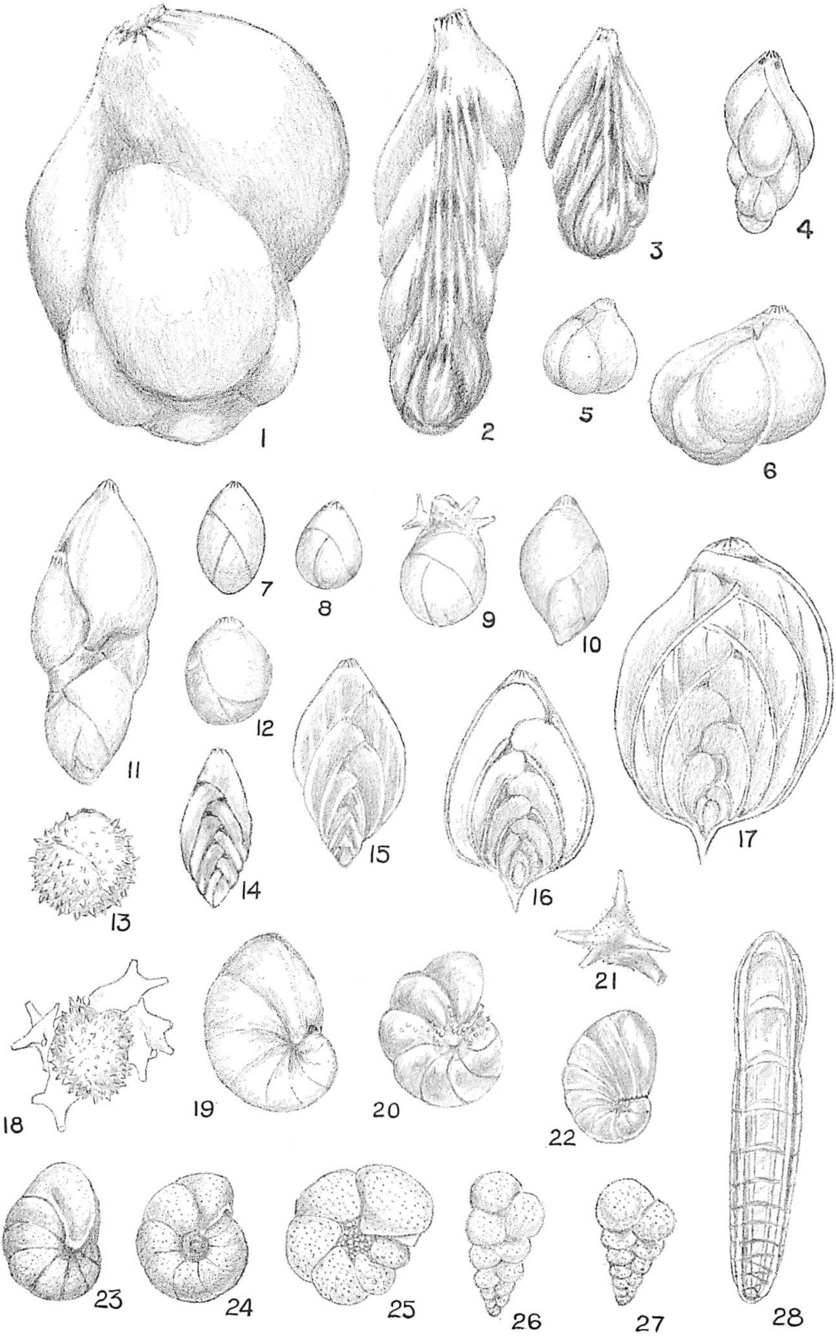

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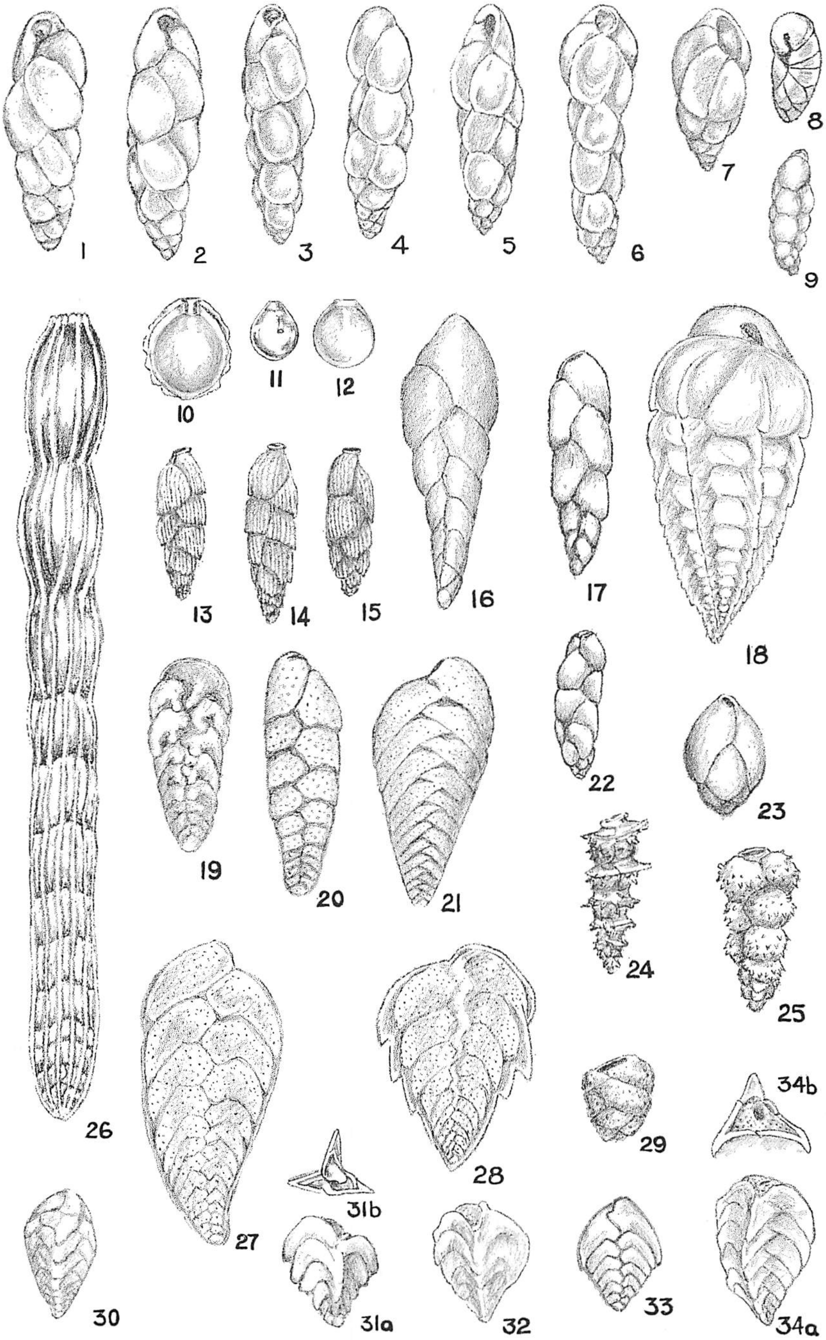

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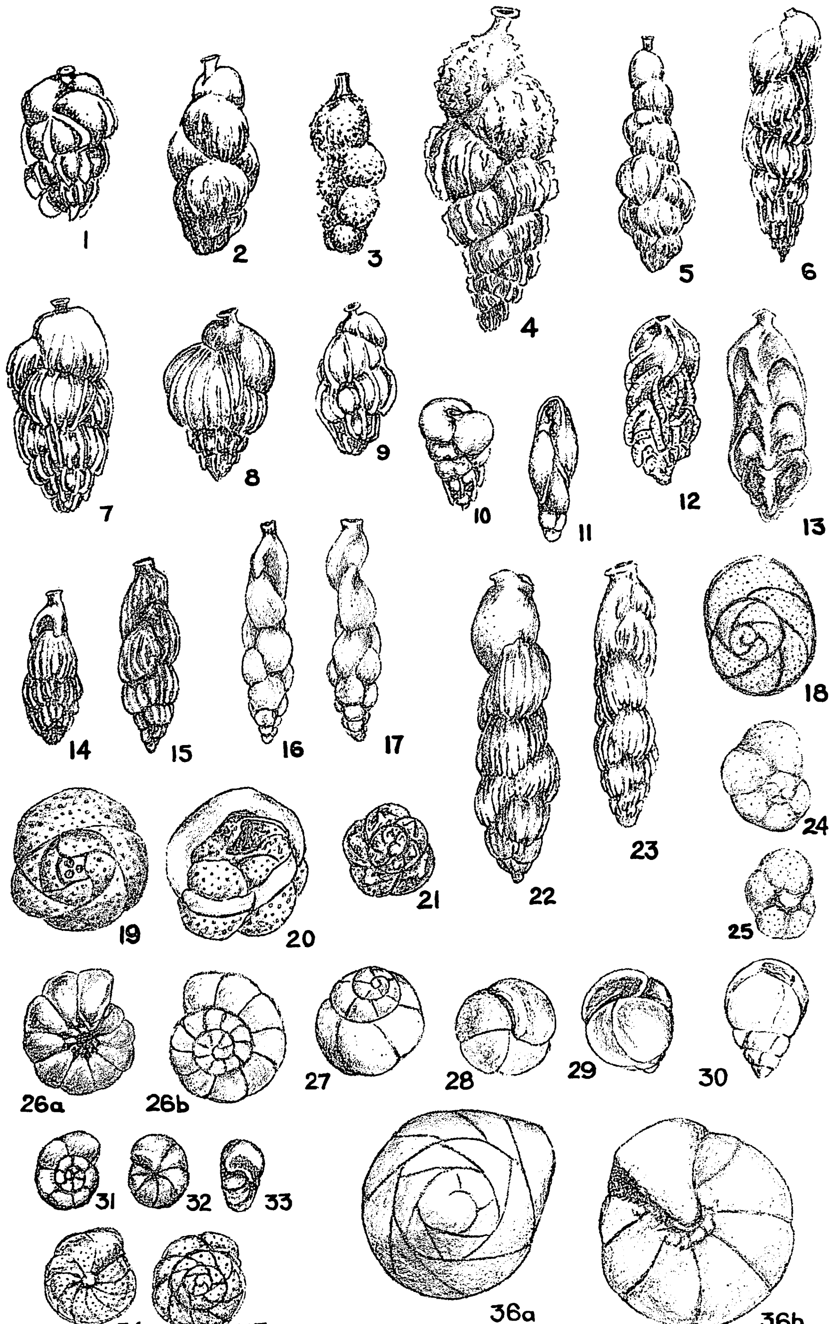

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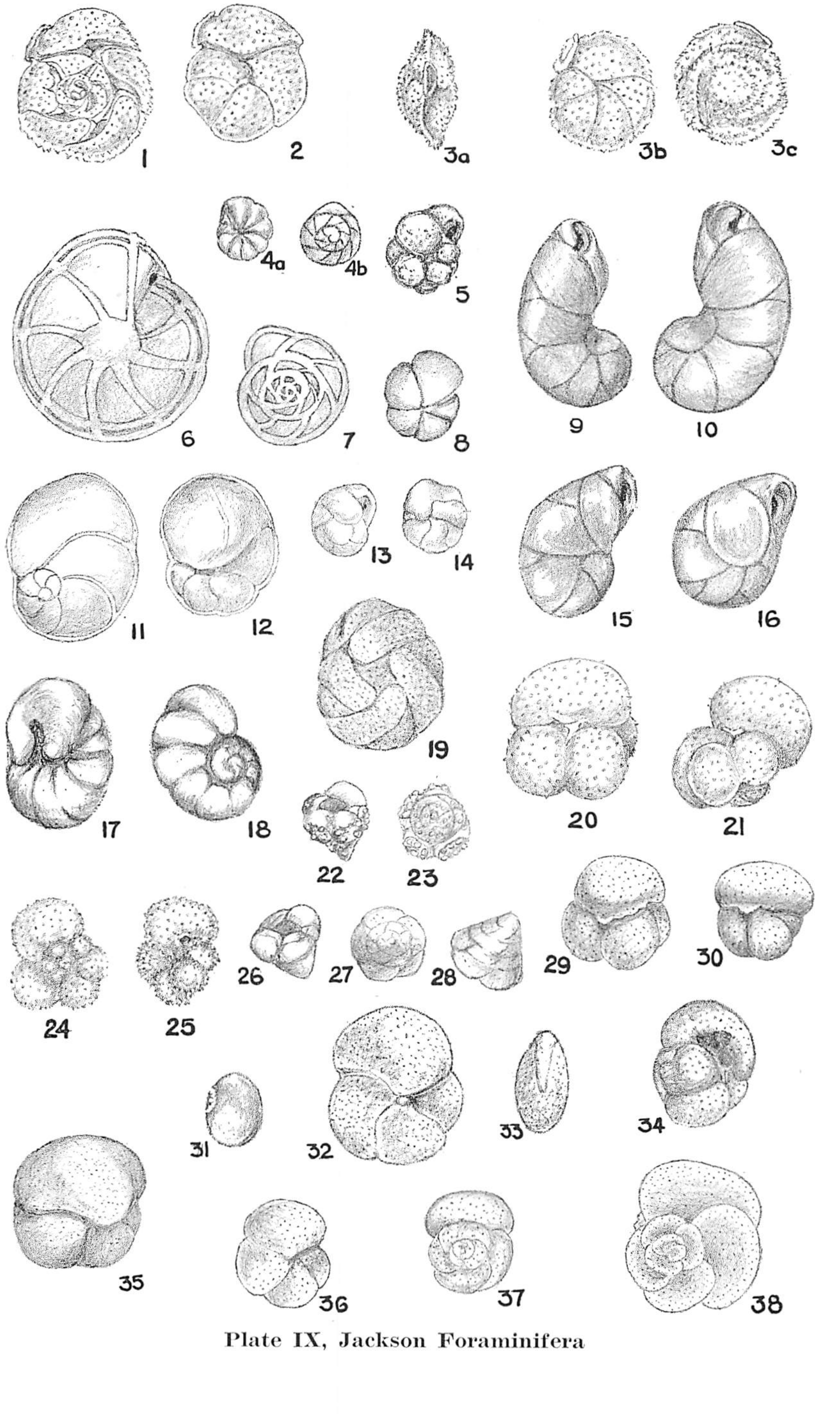

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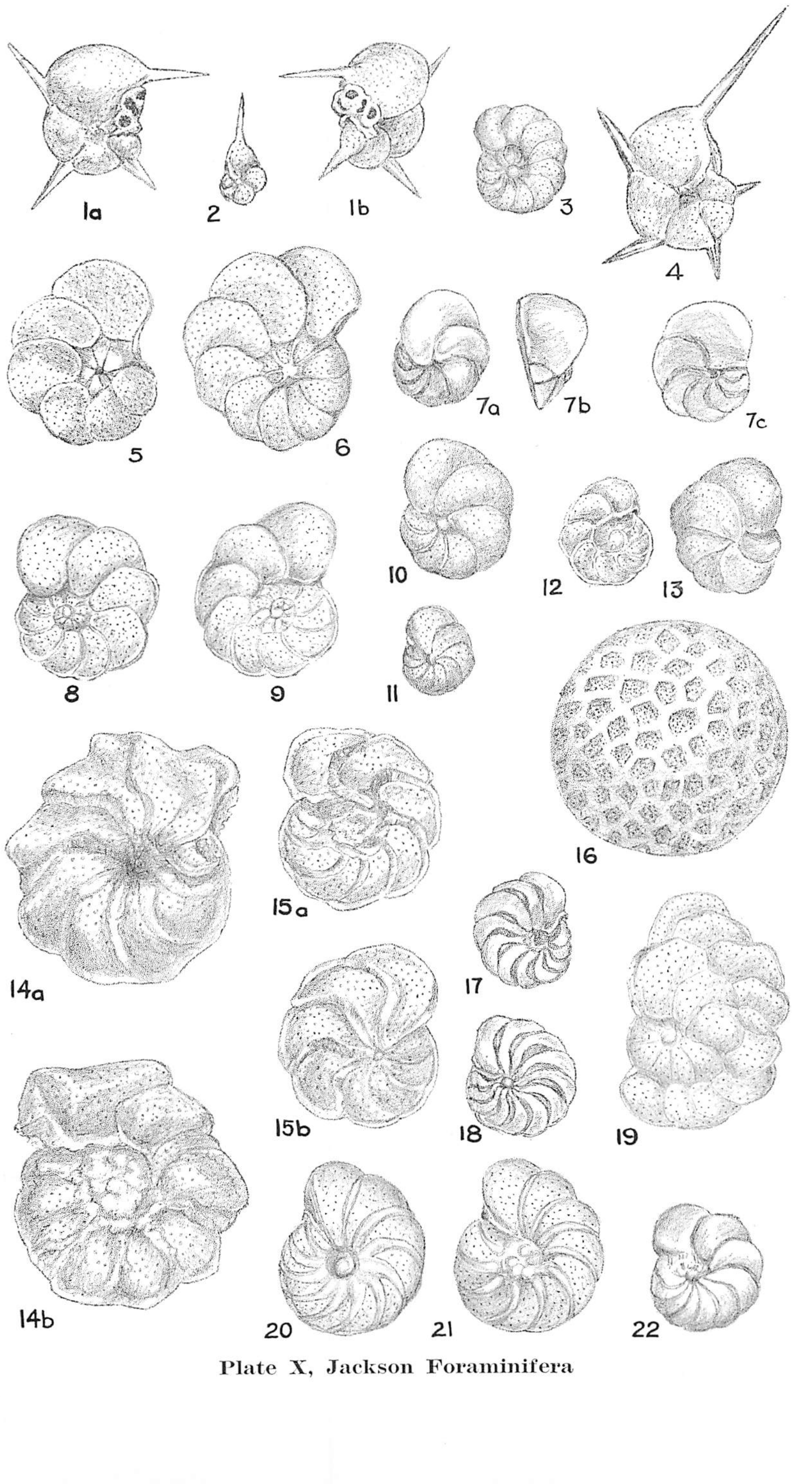

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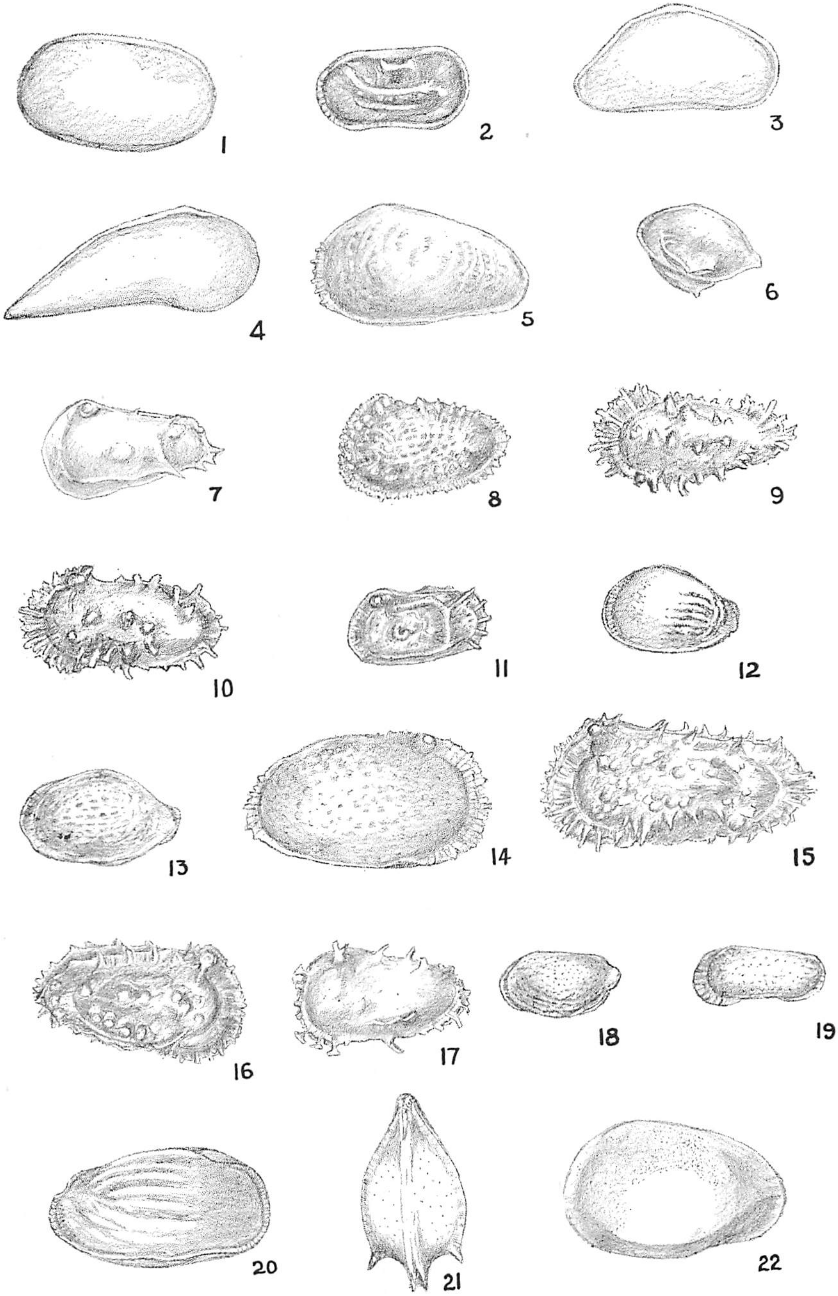

Plate XI, Jackson Ostracoda

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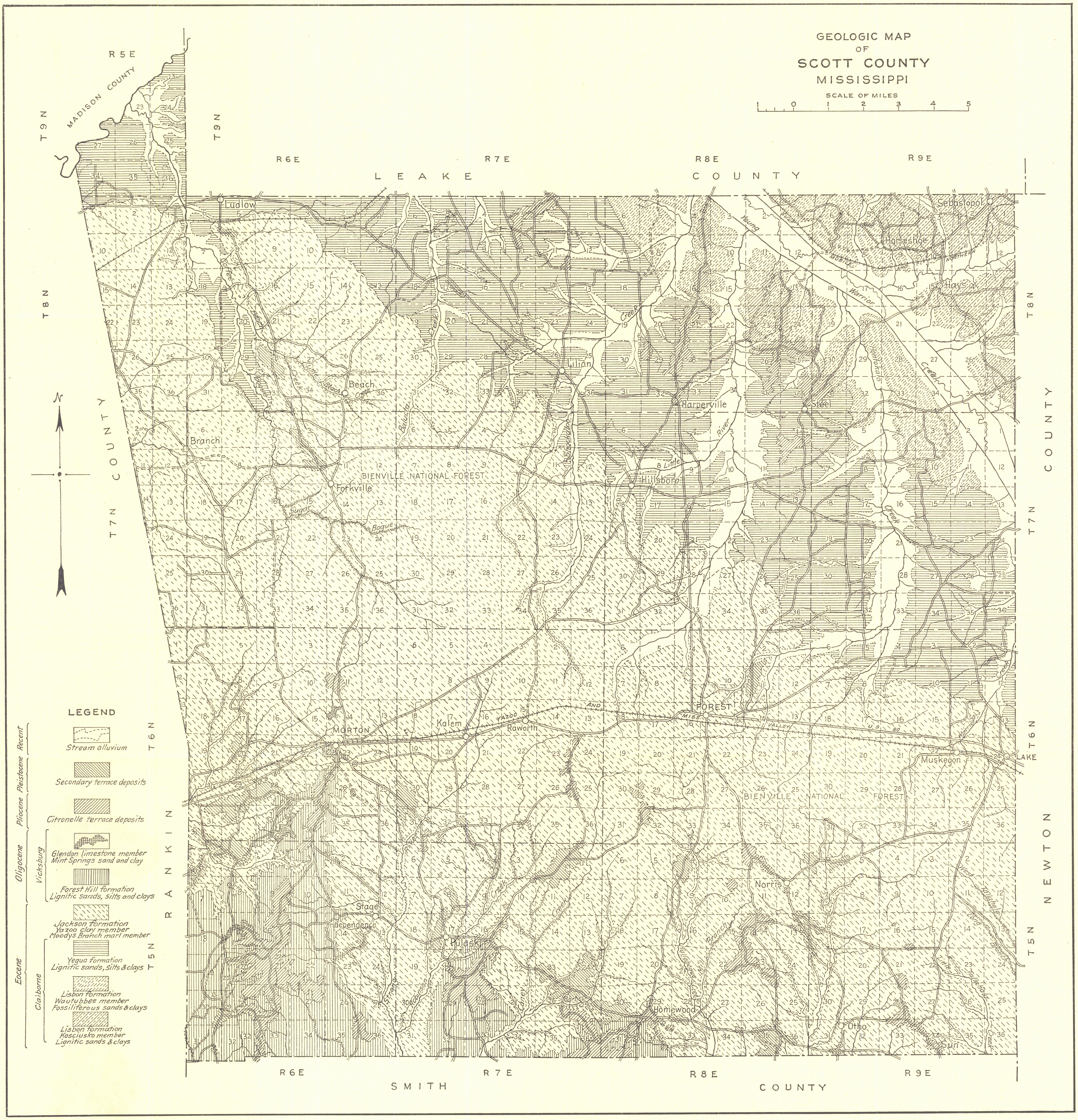
GENERAL

FOSSILS



Two Secondary Terrace remnants are inadvertently delineated as Yegua in Section 5, T. 8 N., R. 7 E. and in Sections 1, 2, 11, and 12, T. 8 N., R. 6 E.