Clarke County
Geology and Mineral Resources

William A. Gilliland

Danny W. Harrelson

BULLETIN 121

MISSISSIPPI DEPARTMENT OF NATURAL RESOURCES
BUREAU OF GEOLOGY

ALVIN R. BICKER, JR.
Bureau Director

Jackson, Mississippi
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LETTER OF TRANSMITTAL

Mississippi Department of Natural Resources

Bureau of Geology

Mr. Jolly McCarty, and
Members of the Commission
Department of Natural Resources

Commissioners:

The Bureau of Geology is pleased to transmit to you Bulletin 121, entitled "Clarke County Geology and Mineral Resources" by William A. Gilliland and Danny W. Harrelson.

This bulletin reports on the geology of one of the more complex areas of the state. Clarke County is one of the more important petroleum producing areas. This publication reports on the volume and location of these petroleum deposits plus other potential resources. A section concerning water resources aids in making this a more comprehensive report on the county's potential. The report contributes to the growing geological knowledge of the state.

Respectfully submitted,

Alvin R. Bicker, Jr.
Director and State Geologist

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CLARKE COUNTY GEOLOGY

William A. Gilliland

ABSTRACT

Clarke County, located in east-central Mississippi, is bounded to the north by Lauderdale County, to the west by Jasper County, to the south by Wayne County, and to the east by Choctaw County, Alabama. The county is located within the parallels 31° 49′ and 32° 15′ north latitude and within the meridians 88° 25′ and 88° 55′ west longitude. Total area of the county is 697 square miles. Quitman is the county seat.

Strata exposed in Clarke County are of Tertiary and Quaternary age. Exposed units in ascending order are: Hatchetigbee Formation of the Wilcox Group—Eocene age; Tallahatta Formation, Winona Formation, Zilpha Formation, Kosciusko Formation, Cook Mountain Formation, and Cockfield Formation of the Claiborne Group—Eocene age; Moodys Branch Formation and Yazoo Formation of the Jackson Group—Eocene age; Red Bluff Formation and Vicksburg Group—Oligocene age; Catahoula Formation—Miocene age; Citronelle Formation and terrace deposits—Pleistocene age; and alluvium—Recent age.

A regional dip of approximately 30 feet per mile to the southwest is indicated for the near-surface strata of Clarke County. Further, numerous faults are present in a zone extending from southeastern Clarke County to the central part of the county, then to west-central Clarke County.

Mineral resources of present or possible future economic importance are gravel, sand, clay, marl, sulfur, natural gas, and petroleum.

INTRODUCTION

The writer joined the staff of the Bureau of Geology in July 1977 and in August 1977 was assigned the task of completing the Clarke County study. A survey of the literature and status of work accomplished was undertaken, followed by a reconnaissance of Clarke County. Field mapping began in September 1977 and was completed in July 1978. Electric logs and sample logs were utilized

along with field locations, measurements and elevations in the construction of the Geologic Map of Clarke County, Mississippi, Plate 1, and the stratigraphic-structural cross sections, Clarke County, Mississippi, Plate 2.

Included in this report is information about the distribution, thickness, and characteristics of the numerous geological units of Clarke County. Possible mineral resources were located, evaluated and their extent determined.

Included, as a major section in this publication, is a hydrological investigation by Danny W. Harrelson.

ACKNOWLEDGMENTS

The writer wishes to take this opportunity to express his appreciation to the many who have made this publication possible. It is an undertaking that could not have been successfully completed without the assistance and cooperation of the people of Clarke County.

Acknowledgment is extended to the wood products companies for granting access to the thousands of areas which they own. Also invaluable were the electrical logs furnished by the various oil companies and the Water Division of the U.S. Geological Survey.

A special thanks is due the members of the Bureau of Geology for their assistance in all phases and all times during this investigation.

DESCRIPTION OF THE AREA

LOCATION AND SIZE

Clarke County, located in east-central Mississippi, is bounded to the north by Lauderdale County, to the west by Jasper County, to the south by Wayne County, and to the east by Choctaw County, Alabama. It is located within the parallels 32° 15′ and 31° 49′ north latitude and the meridians 88° 25′ and 88° 55′ west longitude. Clarke County has a total area of 697 square miles (446,080 acres), being approximately 25 miles north to south and 28 miles east to west. It ranks as the twenty-first largest county in the state (Figure 1).

Figure 1.—Location of Clarke County.

POPULATION

Clarke County according to the 1970 census count had a population of 15,049. The 1975 census estimate lists a figure of 15,306, a growth of 257 or 1.7 percent from 1970 to 1975. The population density (1975 estimate) is 21.96 persons per square mile. Quitman, the largest town in Clarke County and the county seat, is centrally located in the county, and had a population in 1970 of 2,702. Other towns of Clarke County, Mississippi, and their population in 1970 follow: Stonewall, 1,161; Shubuta, 602; Enterprise, 458; and Pachuta, 271.

Communities shown on the county map, published by the Mississippi State Highway Department, are: Archusa Springs, Barnett, Basic City, Beatrice, Brewer, Carmichael, Chancellor, Crandall, Creek, Davis, DeSoto, Elwood, Energy, Goodwater, Harmony, Horn, Hurricane Creek, Indian Mound, Junction City, Langsdale, Linton, Mannassa, Middleton, Nancy, Pine Ridge, Roy, Sable, Shiloh, Sumrall, Sykes, Theadville and Wautubbee.

Employment, as listed by the Mississippi Employment Security Commission, is given on Table I.

ACCESSIBILITY

Clarke County is served by two major highways. U.S. Highway 45, the major highway of eastern Mississippi, leaves Meridian, Lauderdale County, entering Clarke County approximately midway along the north boundary, traverses the county, north to south, passing through Quitman and Shubuta, then exits the county about 0.5 mile south of Shubuta. Interstate 59 passes through the northwestern corner of the county with exit and entrance ramps to Enterprise and Pachuta. Other highways are U.S. 11, paralleling Interstate 59, serving the towns of Enterprise and Pachuta, State Highway 513 from Enterprise through Stonewall to Quitman, and State Highway 18 from Pachuta through Quitman to Butler, Alabama. Other lesser State highways serving the county are 510, 511, 512 and 514. Numerous hard surface, asphalt, roads exist throughout the county. Branching off the hard surface roads and serving the more remote parts of the county are open surface, unpaved, roads which may deteriorate considerably during prolonged wet periods (Figure 2).

Two railroads, Illinois Central Gulf Railroad and Southern Railway System, serve the county. The Illinois Central Gulf serves

Table 1—INDUSTRY AND EMPLOYMENT

CLARKE COUNTY, MISSISSIPPI

Industry	No. Estab.	Employment 1977 April	May	June	Total Quarterly Wages	Average Weekly Wages
Mining	13	85	86	95	346,721	301
Contract Construction	17	82	83	99	181,568	155
Manufacturing	42	2,329	2,357	2,361	5,156,436	169
Lumber and Wood Prod.	31	473	485	476	1,189,440	191
Other Mfg. Incl. Ind.	11	1,856	1,872	1,885	3,966,996	163
Wholesale Trade	16	107	106	106	238,484	173
Retail Trade	57	305	299	311	439,442	111
Finance, Ins. and Real Estate	7	85	84	89	217,808	195
Services	36	373	374	380	434,831	89
Other Divisions Incl.	13	89	91	89	272,676	234
Total All Industries	201	3,455	3,480	3,530	7,287,966	161

Mississippi covered employment and wages, second quarter 1977;
Mississippi Employment Security Commission

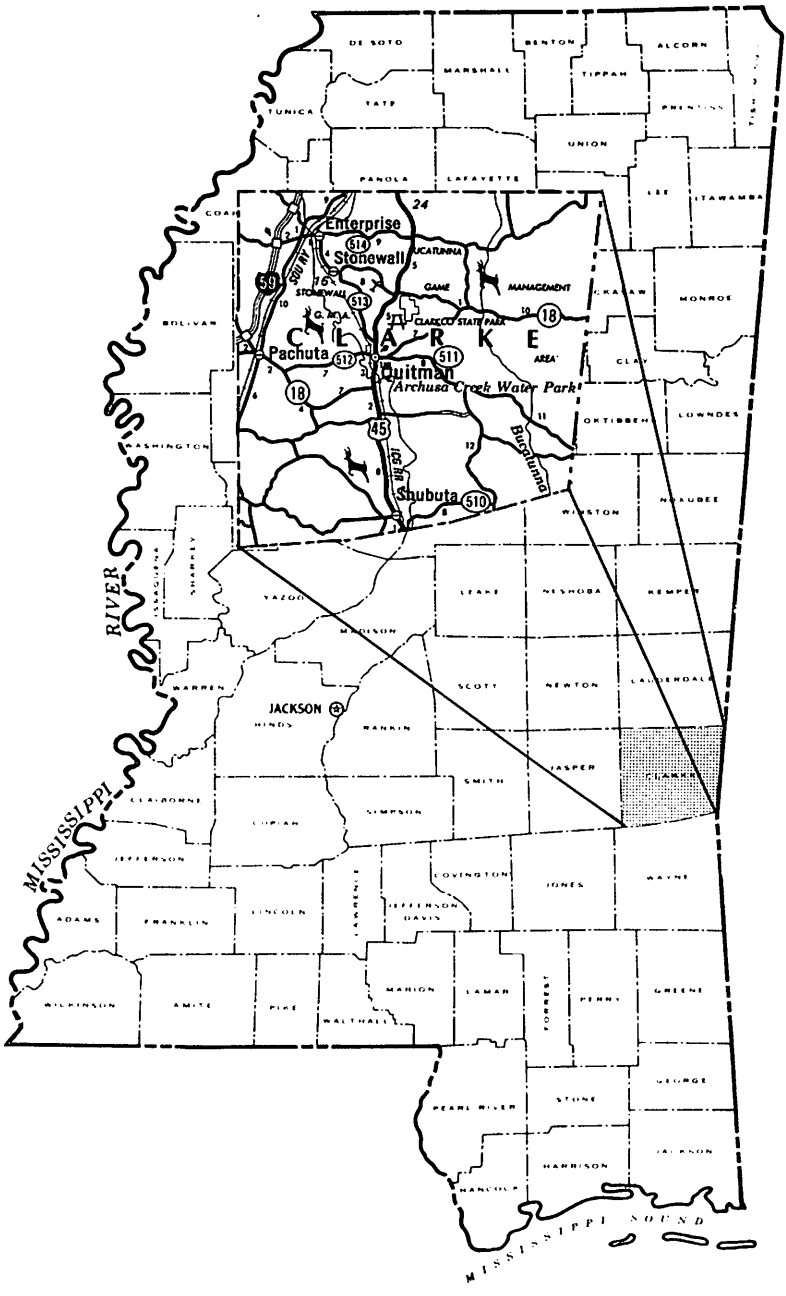

Figure 2.—Railroads and major highways of Clarke County.

the towns of Enterprise, Stonewall, Quitman and Shubuta. The Southern Railway System serves Enterprise and Pachuta.

Clarke County has a municipal airport located approximately three miles north of Quitman and four miles south of Stonewall. Commercial air service is available approximately 25 miles north of Quitman in Meridian, Lauderdale County, Mississippi.

The Chickasawhay River is not navigable at present, but previously was used by flatboats and keelboats between Enterprise and Pascagoula, Mississippi, in the transport of cotton and other merchandise.

CLIMATE

A subtropical humid climate exists for Clarke County, Mississippi. Clarke County's climate is influenced chiefly by its location, the landmass to the north and the warm waters of the Gulf of Mexico to the south.

The summers are characterized by the prevailing southerly winds and moist subtropical air. Although the exception, westerly and northerly winds from the continental landmass transport hot dry air; if these conditions are continued for a sustained time, drought conditions are the result.

Alternating dry polar air and moist tropical air during the winter months result in rapid temperature changes. Although not of an extended duration, freezing temperatures may be associated with the dry polar air masses.

As one may expect, relative humidity is high, varying between 60 and 100 percent for 71 percent of the year.

Precipitation is in general sufficient throughout the year; fall is the driest season and October the driest month. During winter and spring prolonged rains are not unusual. This condition is a result of the warm air from the Gulf of Mexico rising above the cold surface air.

Temperatures, November to April, of 50° F. or less occur approximately 37 percent of the time, temperatures between 50° F. and 70° F. occur approximately 50 percent of the time and temperatures of 70° F. or greater occur approximately 13 percent of the time.

Temperatures of 90° F. or greater are associated with the months of May through October. During this time, temperatures of 90° F. or greater prevail approximately 31 percent of the time and temperatures less than 90° F. prevail approximately 69 percent of the time.

Data is given in Tables 2 and 3 as pertains to precipitation and temperatures, minimum and maximum, for the years 1957 through 1976.

Table 2—ANNUAL PRECIPITATION AND AVERAGE ANNUAL TEMPERATURE
QUITMAN, CLARKE COUNTY, MISSISSIPPI

Year	Precipitation Inches	Temperature Degrees F.
1976	48.01	incomplete data
1975	65.93	64.0
1974	61.82	64.1
1973	72.64	64.3
1972	55.93	64.3
1971	69.60	63.6
1970	45.16	62.7
1969	45.03	61.9
1968	46.76	61.1
1967	52.61	62.1
1966	62.02	62.3
1965	47.65	63.9
1964	81.70	63.4
1963	36.85	63.2
1962	43.98	63.9
1961	84.57	61.8
1960	50.21	62.1
1959	50.30	64.2
1958	50.96	62.7
1957	58.87	65.7
Average	56.53	63.2

Average precipitation and temperature based on a twenty-year record; compiled from available recordings in U.S. Department of Commerce, Weather Bureau (Climatological Data) 1957-1976.

Maximum annual precipitation over this time occurred in 1961 with a total of 84.57 inches. Minimum annual precipitation occurred in 1963 with a total of 36.85 inches. During this period of twenty years there was only one year with less than forty inches of

Table 3—NORMAL MONTHLY, SEASONAL, AND ANNUAL TEMPERATURE AND PRECIPITATION
QUITMAN, CLARKE COUNTY, MISSISSIPPI

Month	TEMPERATURE			PRECIPITATION		
	Average	Absolute Maximum	Absolute Minimum	Average	Absolute Maximum	Absolute Minimum
	F°	F°	F°	Inches	Inches	Inches
December	48.8	81	12	7.89	14.63	3.12
January	46.2	79	4	5.69	13.21	2.38
February	45.6	79	8	5.26	12.76	2.19
Winter	46.9	81	4	19.01	27.14	11.57
March	55.1	87	18	6.19	13.41	2.07
April	64.0	89	28	5.70	10.21	2.09
May	70.0	93	35	4.43	6.40	1.39
Spring	63.0	93	18	16.31	27.75	10.37
June	76.9	102	45	3.16	5.37	0.55
July	79.4	102	51	5.84	9.29	2.30
August	78.4	98	52	4.00	5.61	1.41
Summer	78.2	102	45	13.00	16.07	9.35
September	74.2	99	33	3.90	8.96	1.06
October	63.9	92	28	2.72	6.66	0.58
November	53.1	85	16	2.99	4.61	1.11
Fall	63.7	99	16	9.60	14.74	4.90
Year	63.0	102	4	57.75	72.64	45.03

Average temperature and precipitation based on a ten-year record; compiled from available recordings in U.S. Department of Commerce, Weather Bureau (Climatological Data) 1966 through 1975.

precipitation, there were six years in which the precipitation was between 40 and 50 inches, six years when the precipitation was between 50 and 60 inches, four years in which precipitation was from 60 to 70 inches, one year in which precipitation was between 70 and 80 inches and two years when the precipitation was greater than 80 inches. A difference of 47.72 inches (36.85 to 84.57) has been recorded for annual precipitation of Quitman, Clarke County, Mississippi. Minimum precipitation for any month was 0.00 inches recorded October 1963. Maximum precipitation for any month was 22.26 inches for the month of April 1964. The average annual precipitation based on the twenty years from 1957 through 1976 is 56.53 inches. Mean annual precipitation based on the 25-year period, 1931 through 1955, is shown in Figure 3. During this time, 1931-1955, mean annual precipitation varied from approximately 48 inches in the northeastern corner of the county to approximately 58 inches in the southwestern part of the county.

Temperature statistics do not show as great a spread as do precipitation rates. Mean annual temperatures (1957-1976) varied from a low of 61.1° F. (1968) to a high of 65.7° F. (1957) thereby having a difference of only 4.7° F. Maximum temperatures for the same period of time varied from 95° F. (September 5, 1975) to 105° F. (June 15, 1963). Maximum temperatures were recorded during the months of June through September. Minimum temperatures range from a -3° F. (January 13, 1962) to 17° F. (February 26, 1974), with the low occurring as early as November 30 and as late as February 26. The mean annual temperature based on the years 1957 through 1976 is 63.2° F. (Table 2).

TOPOGRAPHY

The topography of Clarke County is rugged in the northern area with low rolling hills and broad relatively flat lowlands in a belt extending from central western Clarke County to southeastern Clarke County, and of ruggedness in the southwestern corner of the county. The maximum elevation for the county shown on topographic maps is 600+ feet, located in Sec. 6, T.4 N. R.17 E. The highest elevations are located along the dissected ridges paralleling the streams in the northeastern part of the county. Elevations in this area commonly exceed 500 feet. Relief of 200 feet is not uncommon, and relief of 100 feet is the general condition. The lowest elevations of the county are associated with the outcrop of the Yazoo Formation, ranging from a low of 160' feet in Sec. 9, T.10 N., R.7 W., to a high of about 340 feet in Sec. 27, T.3 N., R.14 E. Local

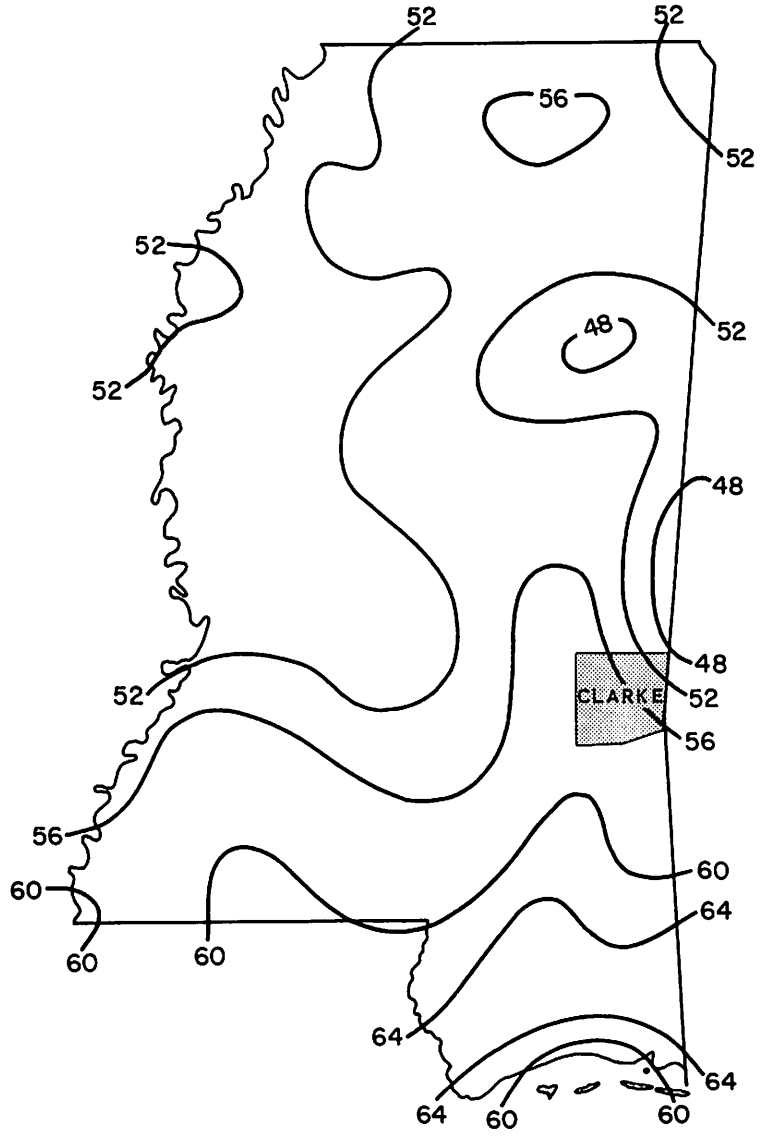

Figure 3.—Mean annual precipitation in inches. From U.S Weather Bureau, 1959, "Climate of the States." Based on 25 year period 1931-1955.

relief throughout this area rarely exceeds 100 feet and is commonly less than 50 feet. Total relief for the county is 440 feet.

Topographic map coverage is available for Clarke County, with approximately 45 percent of the county being represented on 7.5 minute quadrangles and the remaining 55 percent being represented on 15 minute quadrangles. The 7.5 minute quadrangles used in this study are: Heidelberg SW, Eucutta, Shubuta, Matherville, Heidelberg, Hale, DeSoto, Carmichael, Melvin, Hinton and Yantley. Also used were the 15 minute quadrangles Enterprise and Quitman (Figure 4).

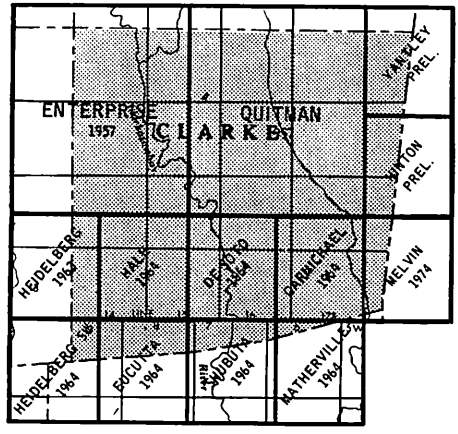

Figure 4.—Topographic map coverage of Clarke County, Mississippi, in 1979.

PHYSIOGRAPHY

Mississippi is located in the Gulf Coastal Plain of North America. Four of the twelve physiographic provinces of Mississippi as described by R. R. Priddy (1960) are present in Clarke County. These four provinces are the North Central Hills, Jackson Prairie, Vicksburg Hills, and Piney Woods (Figure 5).

Covering approximately the northern 69 percent of the county is the North Central Hills Province. Formations at the surface in Clarke County comprising this province are the Hatchetigbee, Tallahatta, Winona, Zilpha, Kosciusko, Cook Mountain, and Cockfield. The materials comprising this province are sands or contain

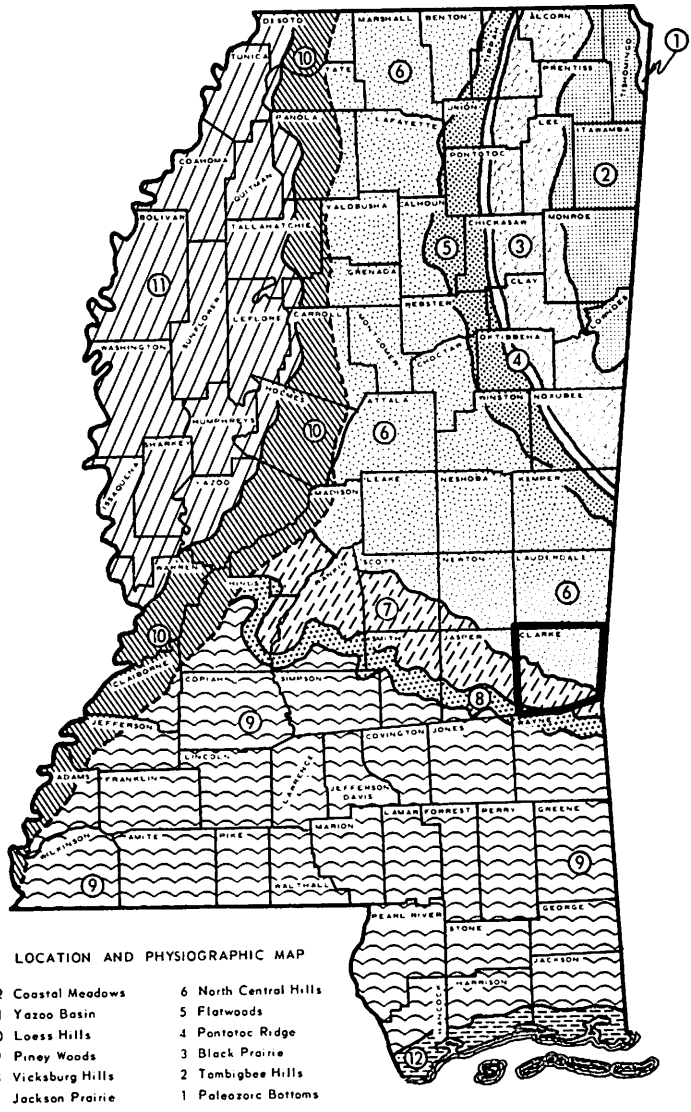

Figure 5.—Physiographic provinces of Mississippi. After R. R. Priddy.

considerable sand, although clays and marls are present and are the major constituent of some formations. Considerable relief is present throughout this province.

The Jackson Prairie Province, covering about 25 percent of the county, consists essentially of heavy, fossiliferous clays. Upon weathering and eroding, the clays produce gently rolling hills and broad, relatively smooth stream valleys. Formations cropping out in this province are the Yazoo and Moodys Branch.

The Vicksburg Hills Province, which occupies a narrow belt in the southwestern part of the county, involves only about 4 percent of the total county area. The materials present in this province are varied, consisting of clays, silts, marls, and limestones, which results in a topographic expression of moderate relief. Included in this province are the Red Bluff Formation and formations of the Vicksburg Group.

Piney Woods Province, located in the southwestern corner of the county, is the least extensive province in the county and comprises only approximately 2 percent of the total area of the county. Formations in the Piney Woods Province are the Catahoula and Citronelle. Topography is hilly with moderate relief.

DRAINAGE

Clarke County, with the exception of the easternmost area, lies within the Pascagoula River Drainage Basin. The Chickasawhay River, which is formed by the junction of the Chunky River and Okatibbee Creek approximately three miles south of the Lauderdale-Clarke County line, flows through Clarke, Wayne, and Greene Counties before it joins with the Leaf River in northern George County to form the Pascagoula River. The Pascagoula River Basin is the second largest drainage basin in the state (Figure 6).

The two major streams of Clarke County are Chickasawhay River and Bucatunna Creek. Chickasawhay River drains the western part of the county and Bucatunna Creek drains the eastern part of the county.

Chickasawhay River, its tributaries, and areas drained are discussed below. Northwestern Clarke County is drained, in part, by Chunky River, Kidd Branch, and Okatibbee Creek. Draining part of northwestern, west-central, and central Clarke County is Souinlovey Creek, which is joined by Tanyard Branch, Twistwood Creek, Chicwillasaw Creek, Pachuta Creek, Gordon Creek, and Shots Creek. Shubuta Creek drains part of west-central and south-central Clarke County by means of Dry Creek, Hollicar Creek, Goodwater Creek, Luke Fleffer Creek, Mingo Creek, Bogue Homo Creek, and

Figure 6.—Pascagoula River Drainage Basin and Clarke County's location in the basin.

Mike Creek. Archusa Creek, with Cedar Creek, Peach Tree Creek, Moore Mill Creek, and Rolling Creek serving as feeder streams, drains the north-central area. Eucutta Creek, which is fed, in part, by Beaverdam Creek and Bogue Flower Creek, drains the southwestern corner of the county. Individual streams flowing into Chickasawhay River are: Allen Branch, Weir Creek, McCants Creek, Jackson Branch, Johns Branch, Alligator Branch, Oaky Creek, Fallen Creek, Youngblood Creek, Rocky Creek, Coonipper Creek, Watts Creek, Garland Creek, and Carson Sand Creek.

Bucatunna Creek, its tributaries, and areas drained are discussed below. Long Creek, with its tributaries Dry Creek, Chinguapin Creek, Riley Mill Creek, and Ivy Mill Creek, drains eastern north-central Clarke County. Hurricane Creek, with Bean Creek, Goddin Creek, and Johnnie Branch, drains the northeastern part of the county. Draining the east-central area are Rocky Creek and Greasy Creek. Other tributaries of Bucatunna Creek are Irby Mill Creek, Brown's Creek, Mott's Creek, Cedar Creek, Tallabouge Creek which is joined by Long Branch, Fivemile Creek, Double Creek, and Hanging Moss Creek with its tributary Bolingchessa Creek.

In the most eastern part of Clarke County streams flow into the Tombigbee River by means of Bogue Chitto Creek and Okatuppa Creek with its tributaries Pocolechetto Creek and Little Okatuppa Creek.

SURFACE STRATIGRAPHY

GENERAL STATEMENT

Strata exposed in Clarke County are of Quaternary and Tertiary age. Recent and Pleistocene deposits comprise the Quaternary. Miocene, Oligocene, and Eocene deposits comprise the Tertiary.

Transgressive and regressive depositional environments are evident from the stratigraphy. Such environments are responsible for the varied lithologic character of the formations that crop out in the county. Figure 7 is a generalized stratigraphic section of strata located in Clarke County.

The Geologic Map of Clarke County, Plate 1, shows the areal extent of the outcrops of the formations. Clarke County is covered largely by soil, terrace deposits, and alluvium. Due to the amount of cover, the formation contacts on the map are approximate contacts only; it is not the intent of the writer to imply that a contact

SYSTEM	SERIES	GROUP	STRATIGRAPHIC UNIT		LITHOLOGY	THICKNESS
QUATERNARY	RECENT		Alluvium		Sand, yellowish- gray to yellowish- orange fine- to coarse-grained, pea gravel, clayey in part	0 to 34'
	PLEISTOCENE		Terrace deposits		Sand, multicolored, usually various shades of orange and brown, fine- to coarse-grained, minor gravel, local clay lenses.	0 to 44'
			Citronelle Formation		Sand, mostly yellowish- orange to red, fine- to coarse- grained Gravels, multicolored, massive, cross- bedded, lenstic Local clay lenses	0 to 120'
	MIOCENE		Catahoula Formation		Sand, brown, gray, fine- to medium- grained Some pea gravel Clay, light gray, light green and moderate red Silt, brown to light gray	0 to 86'
TERTIARY	OLIGOCENE	VICKSBURG	Bucatunna Formation		Clay, gray to dark greenish- gray, carbonaceous, fossiliferous	0 to 27'
			Byram Formation		Marl, dark gray to dark greenish- gray, clayey, fossiliferous, glauconitic	0 to 14'
			Glendon Formation		Limestone, light gray to gray, fossiliferous, sandy, pyritic Interbeds of clayey marl	0 to 18
			Marianna Formation		Marl, light gray to yellowish- gray, clayey, fossiliferous, limestone ledges	0 to 24
			Mint Spring Formation		Marl, light gray, bluish- gray, clayey to sandy, fossiliferous, glauconitic	0 to 20
			Red Bluff Formation		Clay, gray to dark gray, silty, sandy, carbonaceous, fossiliferous	0 to 124'
	EOCENE	JACKSON	Yazoo Formation	Shubuta Clay	Clay, light grayish- green, fossiliferous, calcareous	0 to 128
				Pachuta Marl	Marl, white, light gray, buff, sandy, fossiliferous, glauconitic, local limestone ledges	0 to 25'
				Cocoa Sand	Sand, light gray to light greenish- gray, fine- grained, fossiliferous, clayey, indurated calcareous streaks	0 to 30
				North Twistwood Creek Clay	Clay, light greenish- gray to light grayish- green, silty, calcareous, fossiliferous	0 to 70'
			Moodys Branch Formation		Marl, greenish- gray, brownish- gray, sandy, clayey, fossiliferous, glauconitic	0 to 25'
		CLAIBORNE	Cockfield Formation		Sand, gray, brown, black, fine- to medium- grained, clay, lignitic	0 to 112
			Cook Mountain	Gordon Creek Shale	Clay, shale, chocolate brown, dark greenish- gray, gray, silty, carbonaceous	0 to 67'
				Potterchitto	Marl, light gray to greenish- gray, sandy, clayey, glauconitic, fossiliferous	0 to 21'
				Archusa Marl	Marl, light gray to greenish- gray, sandy, clayey, fossiliferous, glauconitic	0 to 60'
			Kosciusko Formation		Sand, gray, brownish- gray, black, fine- to coarse- grained, some clay, cross- bedded, glauconitic, carbonaceous to lignitic	0 to 167'
			Zilpha Formation		Clay, brownish- gray, greenish- gray, sandy, glauconitic, carbonaceous	0 to 100
			Winona Formation		Sand, greenish- gray to grayish- green fine- grained, clayey, fossiliferous, glauconitic, partially indurated to indurated	0 to 38
			Tallahatta Formation	Neshoba Sand (?)	Sand, light gray, medium- grained clay lenses	0 to 12'
				Basic City Shale	Claystone, clay, light gray, bluish gray, greenish gray, sandstone, carbonaceous, glauconitic	0 to 202'
				Meridian Sand	Sand, light gray to brownish- gray, fine- to coarse- grained, , cross- bedded to massive, lignitic, glauconitic	0 to 80
		WILCOX	Hatchetigbee Formation		Clay, sand, silt, gray to brown, carbonaceous to lignitic, glauconitic	0 to 260
			Bashi Formation		Marl, light gray to gray, sandy, fossiliferous, glauconitic, limestone concretionary boulders	not Exp

Figure 7.—Generalized section of strata exposed in Clarke County. As all units listed, Bashi excepted, crop out in Clarke County and pinch out along the northern edge of the outcrop zone, minimum thickness is given as 0 for each unit.

can be traced for a considerable distance on the surface. The dip of the strata is to the southwest; therefore, the oldest deposits are located in northeastern part of the county.

Figure 8 shows the location of the test holes cored and drilled for the project. Data from numerous other wells were utilized in the construction of the map and cross sections. Although the majority of the test holes were drilled for stratigraphic control, a few were drilled for specific economic purposes, such as to determine the depth of a gravel deposit, quality of a clay, etc. Further discussion is in the section on Test Hole and Core Hole Records.

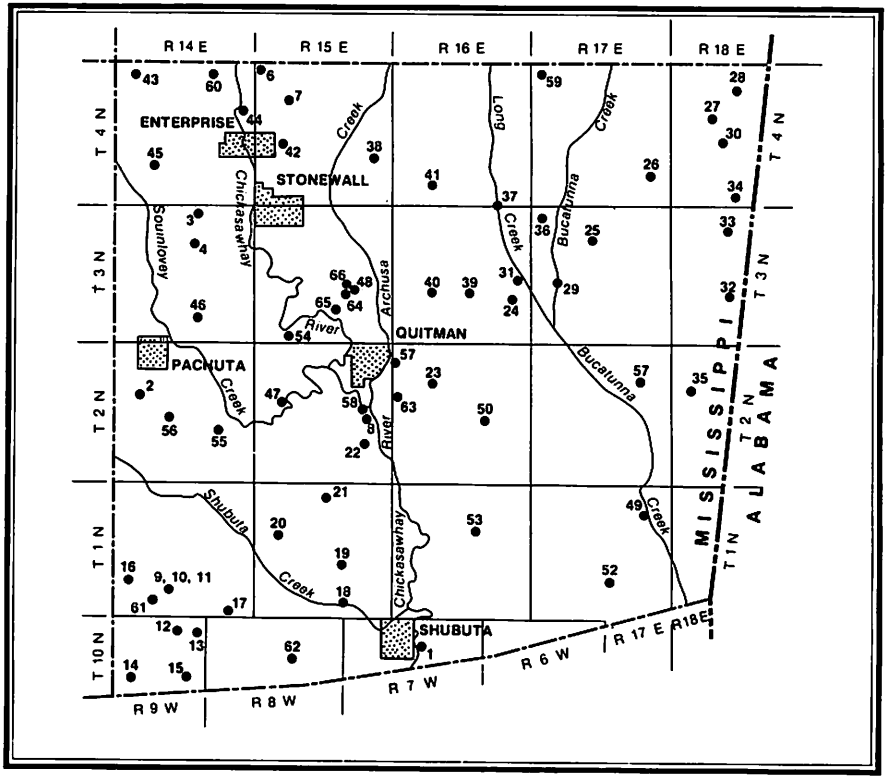

Figure 8.—Test hole locations in Clarke County.

EOCENE SERIES

WILCOX GROUP

HATCHETIGBEE FORMATION

Cropping out in the northeastern corner of Clarke County are strata of the Hatchetigbee Formation. This formation derived its name from Hatchetigbee Bluff on the Tombigbee River in Sec. 16, T.18 N., R.1 W., Washington County, Alabama. The first use of the term was by Smith and Aldrich (1886) and the following year the formation was defined by Smith and Johnson (1887) to include all beds lying between the "base of the Buhrstone (Tallahatta) and the uppermost of the Woods Bluff (Bashi) fossiliferous beds." An unconformity between the lignitic sands and clays of the typical Hatchetigbee and the thick sand (Meridian), which immediately underlies the claystone in Mississippi, was described by Lowe (1933, p. 106-108), at which time he limited the formation to those beds between the "basal sand of the Claiborne Group" and the Bashi. This terminology is used in Mississippi at present.

To the north of Clarke County, in Lauderdale County, Foster (1940, p. 61-68) described the formation as "composed of lignitic sands, sandy silts, and silty or sandy clays interbedded one with the other. In general, the basal part of the formation is more sandy than the upper part, and northwest of Meridian, extending to the county line north of Post . . . it is easily separable into two members, an upper member composed of clay-shale, including one well-developed lignite bed 1.0 to 2.5 feet thick, and a lower member composed of relatively fine- or medium-grained sand locally grading down into coarse grit-bearing sand. Southeast of Meridian, however, the upper member either grades laterally into a more sandy facies or the formation is partly overlapped by the Meridian sand."

In Choctaw County, Alabama, the Hatchetigbee Formation is approximately 250 feet thick and consists essentially of fine- to medium-grained, gray, brown, and olive-green sand and interlaminated carbonaceous clays (Toulmin, et al., 1951, p. 74-93).

Although Foster divided the Hatchetigbee Formation into an upper and a lower member north of Meridian, Lauderdale County, Mississippi, he was not able to continue this division south of Meridian. Likewise, division of the formation into an upper and a lower member was not possible in Clarke County in the field or from electric logs.

The Hatchetigbee Formation in Clarke County is composed of light-gray to brownish-gray to greenish-gray clays, interbedded silty to sandy clays, sandy silts and fine- to medium-grained sands, and associated carbonaceous to lignitic deposits. Sand units in excess of 50 feet in thickness are locally present in the upper or lower part of the formation. In Test Hole AN-59 in the SE/4, NW/4, Sec. 6, T.4 N., R.17 E., sand having a total thickness of 71 feet was encountered in the upper part of the formation. Test Hole AN-27 in the SE/4, NE/4, Sec. 17, T.4 N., R.18 E., encountered 51 feet of sand in the lower part of the formation. Clay, 80 feet thick, is present in the upper part of the formation in Test Hole AN-34 in the NW/4, SE/4, Sec. 33, T.4 N., R. 18 E. Further, in this hole, AN-34, the upper 200 feet of the Hatchetigbee Formation is chiefly clay, silty clay, sandy clay or clayey silt.

The Hatchetigbee Formation varies in thickness from a thin edge along the updip limit of the outcrop zone where a true thickness is not present to a thickness of approximately 260 feet downdip of the outcrop zone where the entire formation is present. In Test Hole AN-27 in the SE/4, NE/4, Sec. 17, T.4 N., R.18 E., which began in the Hatchetigbee Formation, the Bashi Formation was encountered at a depth of 182 feet. In Test Hole AN-34 in the NW/4, SE/4, Sec. 33, T.4 N., R.18 E., the Hatchetigbee Formation was encountered at a depth of 126 feet and drilling continued in the formation to a depth of 300 feet without reaching the Bashi Formation. In a water well, downdip from the outcrop zone (Harmony Water Association, in the NE/4, SE/4, Sec. 34, T.4 N., R.15 E.), a total of 260 feet of Hatchetigbee Formation was penetrated.

The Hatchetigbee Formation crops out in the northeastern part of the county with outcrops being present notably in the cuts of the north-south road in Sec. 4, T.4 N., R.18 E., in the cuts of the east-west road beginning approximately 0.3 mile east of Energy in Sec. 22, T.4 N., R.17 E., and continuing east through Sec. 10, T.4 N., R.18 E., to the Mississippi-Alabama State Line, and in the cuts of the north-south road along the east border of Sec. 24, T.4 N., R.17 E. (Figures 9 and 10).

Although projection of the Bashi Formation to the surface from the depths the formation was encountered in Test Holes AN-27 and AN-28 indicates the Bashi Formation may crop out in northeasternmost Clarke County, the Bashi was not located at the surface any place within the county.

Figure 9.—Sand with thin clay lenses. Location, roadcut in the NE/4, Sec. 9, T.4 N., R.18 E., Hatchetigbee Formation.

Figure 10.—Close-up of the above showing cross-bedded sands and clay lenses of the Hatchetigbee Formation.

An unconformity separates the underlying Hatchetigbee Formation from the overlying Meridian Sand member of the Tallahatta Formation. Distinguishing the break between these two units, Hatchetigbee and Meridian, may be easy or extremely difficult with the chief factor being the composition of the uppermost Hatchetigbee. In those areas where clay is present in the uppermost Hatchetigbee and is overlain by sand of the Meridian (Figure 11), the contact is identified easily. At localities where the uppermost Hatchetigbee is sand, overlain by sand of the Meridian, the contact dividing the two units is difficult to distinguish. This condition, sand over sand, makes for difficulty in separating the two units not only in the field but on electric logs also.

Test holes in which the Hatchetigbee Formation was encountered in Clarke County are AN-6, 7, 25, 26, 27, 28, 34, 44, and 59. Test Hole AN-5, located in Lauderdale County, also encountered Hatchetigbee deposits.

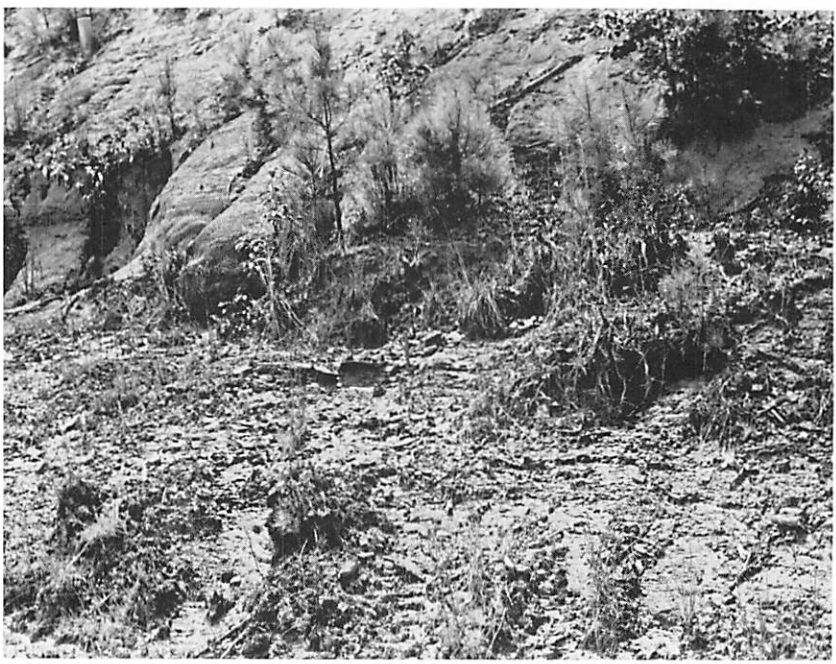

Figure. 11—Hatchetigbee-Meridian Sand Contact. Silty clays of the Hatchetigbee overlain by sand of the Meridian Sand. Located in roadcut in the NE/4, SE/4, Sec. 24, T.4 N., R.17 E.

CLAIBORNE GROUP

Claiborne, as a term, was introduced into the literature by Conrad (Wilmarth, 1938) in 1847 when he stated "Claiborne sand" for exposures at Claiborne Bluff, Alabama, from which he described numerous fossils. The Claiborne was first identified in Mississippi by Hilgard (1860, p. 123-128) and divided into an upper "Calcareous Claiborne Strata" and a lower "Siliceous Claiborne Strata."

The Claiborne is overlain by the Jackson Group and underlain by the Wilcox Group. In Mississippi the Claiborne Group is divided as follows:

Cockfield Formation
Cook Mountain Formation
    Gordon Creek Shale member
    Potterchitto member
    Archusa Marl member
Kosciusko Formation
Zilpha Formation
Winona Formation
Tallahatta Formation
    Neshoba Sand member
    Basic City Shale member
    Meridian Sand member

TALLAHATTA FORMATION

The term Tallahatta first appeared in print in an article by Dall (1898) after being suggested to him by E. A. Smith as a replacement for the term "Buhrstone" and has remained in use since. The name was taken from the Tallahatta Hills, which extend northwestward in an arc across the northcentral part of Choctaw County, Alabama. In Mississippi, Tallahatta has been in use since its introduction by Johnson (Thomas, 1942, p. 15) in 1905, replacing the name "Siliceous Claiborne" as previously used by Hilgard. The Tallahatta Formation in Mississippi is divided into the following:

Neshoba Sand member
Basic City Shale member
Meridian Sand member

MERIDIAN SAND MEMBER

The term Meridian had its origin in 1933 when introduced into

the literature by Lowe (1933, p. 107) in his reference to "Meridian beds of yellow sand". Lowe included the Meridian in the Tallahatta and considered it to be basal Claiborne. Foster (1940, p. 68-72) raised the Meridian to formational rank, based on his observations in the study of Lauderdale County Mississippi. Presently the Meridian is classified as a member of the Tallahatta Formation by the Bureau of Geology (Childress, 1973, p. 89-90).

Foster (1940, p. 70) reports that the Meridian Sand in Lauderdale County has a maximum thickness of approximately 100 feet but may vary, over a distance of 10 to 12 miles, by 50 feet or more. To the east, in Choctaw County, Alabama, no data are given for the Meridian as it is the policy of the Geological Survey of Alabama to classify the Meridian as part of the Hatchetigbee Formation.

In Clarke County the Meridian Sand consists of fine- to coarse-grained, light-gray to gray, usually weathering buff, massive to cross-bedded sand containing thin interbeds and locally developed lenses of clay (Figure 12). In the outcrop area in Clarke County, the Meridian Sand ranges in thickness from 0 along the updip edge of the outcrop to approximately 40 feet at the downdip edge of the outcrop zone. Downdip of the outcrop zone a thickness of 80 feet was recorded in a water well located in the NE/4, SW/4, Sec. 2, T.2 N., R.15 E.

The outcrop zone of the Meridian Sand member in Clarke County is confined to the northeastern part of the county. Due to the limited thickness and lack of resistance to erosion the Meridian Sand generally does not occupy the uppermost position on hills and along ridges. Instead, the Meridian Sand is most often found along the side of a hill with the Basic City Shale member with its much greater resistance to erosion and greater thickness providing a protective, resistant overlying material.

Outcrops of the Meridian Sand member are present along the unimproved roads of Secs. 10 and 15, T.4 N., R.17 E., and in the road cuts along the north-south road along the east boundary of Secs. 24 and 25, T.4 N., R.17 E., and the west boundary of Secs. 29 and 30, T.4 N., R.18 E.

Separating the underlying Meridian Sand member and the overlying Basic City Shale member is a disconformity which is marked by a lithologic change from sand of the Meridian to clay and claystone of the Basic City. The Meridian-Basic City contact

Figure 12.—Meridian Sand outcrop. Located in a roadcut in the SW/4, SW/4, Sec. 30, T.4 N., R.18 E. William L. Gilliland, son, in photo.

can be viewed at numerous localities where it is displayed in roadcuts and along unimproved roads in T.4 N., R.17 E. and R.18 E. Shown in Figures 13 and 14 is the contact between the Meridian Sand member and the Basic City Shale Member as it appears along a deteriorating unimproved road in Sec. 10, T.4 N., R.17 E.

The Meridian Sand was encountered in Test Holes AN-5, 6, 7, 24, 25, 26, 34, 36, 37, 44, and 50.

Basic City Shale Member

The type locality of the Basic City is along the Illinois Central Gulf Railroad approximately one-half mile north of Basic City, Clarke County, and into Lauderdale County. At this locality is a series of relatively deep cuts into the hillside which typically exposes this member of the Tallahatta Formation (Figures 15 and 16). The first reference to the term was by Lowe (1915, p. 74-76) at which time he made note of the above outcrop. Lowe (1919, p. 74-77)

Figure 13.—Contact between Meridian Sand member and Basic City Shale member of Tallahatta Formation. Leslie Gilliland, son, standing at contact. Location, Sec. 10, T.4 N., R. 17 E.

Figure 14.—Contact between Meridian Sand member and Basic City Shale member of Tallahatta Formation. Top of hammer handle at contact. Location, Sec. 10, T.4 N., R.17 E.

Figure 15—Basic City Shale at the type locality approximately 1 mile north of Basic City. Location: NE/4, NW/4, Sec. 4, T.4 N., R.15 E.

uses the subheading "Basic Claystone" and lists the strata as consisting of white quartzite at the top, beneath which yellowish-white claystone in thin beds forms the face of the cliffs below the quartzite.

In Clarke County the Basic City Shale is comprised chiefly of siliceous claystone, with lesser amounts of siltstone and sandstone and clay interbedded. Color of the Basic City Shale, when fresh, is generally a light-gray to a light-greenish-gray, although darker colors are present. On weathering the claystones become brittle, yellowish-white or light colored, relatively light weight, and break with a subconchoidal fracture. Thickness varies from a thin edge in parts of the outcrop zone to a maximum of approximately 202 feet in a water well located in the SE/4, SW/4, NE/4, Sec. 5, T.2 N., R.14 E.; the thickness is usually of the magnitude of 100 feet to 125 feet. The Basic City Shale, owing to its resistance to erosion, produces a rugged topography with local relief exceeding 100 feet in places, thus forming the upper part of a high steep cuesta. The presence of the Basic City Shale influenced the route of the railroads through northern Clarke County and likewise many of the earlier roads in the county.

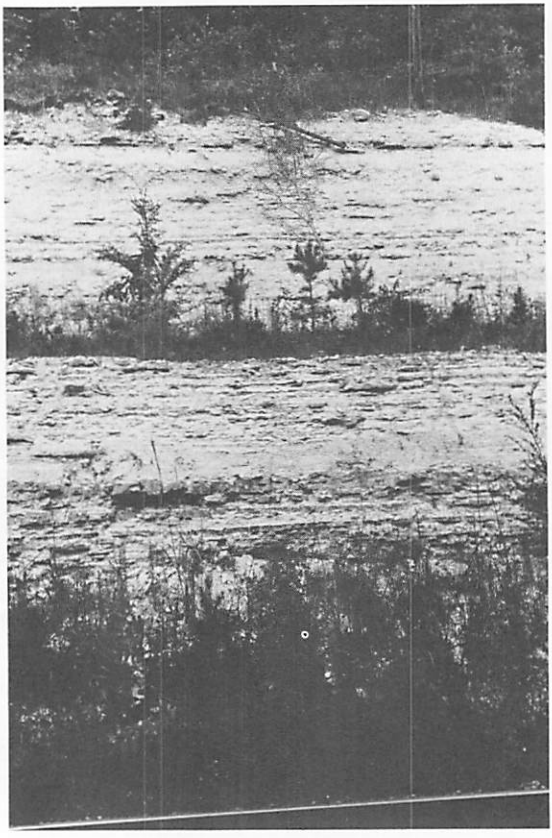

Figure 16.—Closer picture of the Basic City Shale at the type locality. Location: NE/4, NW/4, Sec. 4, T.4 N., R.15 E.

The outcrop belt of the Basic City Shale member occurs chiefly in northeastern Clarke County. Along the Mississippi-Alabama State Line the Basic City Shale occupies that area included in the N/3, T.3 N., R. 18 E., and the S/2, T.4 N., R.18 E., then trending in a west-northwesterly direction to the Clarke-Lauderdale County Line, and mainly occurs within that area of the E 3/4, T.4 N., R.16 E., and the W/3, T.4 N., R.17 E. Other exposures of the Basic City Shale are located outside the above delineated area, most notably along Okatibbee Creek in northwestern Clarke County.

The upper contact, Basic City Shale-Winona, is usually covered or poorly exposed in most areas, but wherever the contact can be

located the transition from clay or claystone to a glauconitic or highly ferruginous clayey sand or clayey marl is generally sharp.

Test holes in which the Basic City Shale was present are AN-5, 6, 7, 24, 25, 26, 31, 32, 33, 34, 35, 36, 37, 39, 41, 42, 43, 44, 51, 59, and 60.

Neshoba Sand Member

Overlying the Basic City Shale and underlying the Winona Formation, in part, is a unit referred to as the Neshoba Sand. Reference was originally made to the Neshoba Sand by Thomas (1942, p. 24) at which time he described it as "a section of non-glauconitic to sparingly glauconitic sand". He further states "in northeastern Clarke and southeastern Lauderdale Counties the Basic constitutes the entire Tallahatta Formation." (Note: Thomas did not consider the Meridian Sand to be a member of the Tallahatta Formation.)

In Clarke County no outcrop of the Neshoba Sand was observed and in only one test hole, Test Hole AN-4l, did a sand overlying the claystone and clay of the Basic City Shale and underlying the Winona occur. This sand, thickness 12 feet, is a light-greenish-gray, micaceous, medium-grained sand with minor clay stringers. It is the opinion of the writer that this is a lens within the Basic City Shale, not an outlier of the Neshoba Sand, and that the Neshoba Sand does not exist in Clarke County.

Winona Formation

Winona as a name was proposed by Lowe (1919, p. 73-74) for exposures around Winona, Montgomery County, Mississippi. He gives the description "highly glauconitic sands and clayey sands that weather to an intense Indian red color where exposed at the surface. This material is marine in origin and locally abundantly fossiliferous." He erroneously placed these beds termed Winona below rather than above the Basic City Shale. Cooke (1925, p. 135) was first to recognize and correctly correlate the greensands of Winona and the greensands of Enterprise as the same unit, thus including in the Winona all beds above the Basic City Shale member and below the Zilpha Formation. (Note: The Neshoba Sand as a unit was not introduced to the literature until 1942.)

Prior to 1942, depending upon the preference of the author, the Winona was classified as either a member of the Tallahatta or a

member of the Lisbon Formation. Thomas (1942, p. 29) raised the Winona to formational rank and stated: "It is raised to formation rank in this report, because it is a very distinctive lithological unit which has a wide areal distribution, it being the only formation in the Claiborne which extends all the way across the state without extensive facies changes."

The Winona Formation in Clarke County consists of clay, silt, and fine-grained sand, light-gray to greenish-gray in color, fossiliferous, calcareous, glauconitic, pyritic, and contains indurated streaks. The Winona Formation upon weathering tends to produce a reddish-brown, ferruginous, clayey sand.

Thickness of the Winona varies from 0, at the pinchout of the outcrop, to a maximum of 38 feet penetrated in Test Hole AN-43 in the SE/4, NE/4, Sec. 6, T.4 N., R.14 E. The minimum thickness, 6 feet, of the Winona Formation encountered in a test hole was in Test Hole AN-33 in the NE/4, NW/4, Sec. 9, T.3 N., R.18 E. Due to the limited thickness the Winona Formation is generally located in an intermediate position on a hillside. The outcrop zone is a highly irregular thin belt across northern Clarke County trending in a west-northwest to east-southeast direction. Outcrops may be viewed along the Chickasawhay River in the SE/4, Sec. 24, T.4 N., R.14 E., and in roadcuts in the SE/4, SE/4, Sec. 22, T.4 N., R.16 E., (Figure 17) and in the SE/4, NE/4, Sec. 7, T.4 N., R.15 E. (Figure 18).

Overlying the Winona Formation is the Zilpha Formation with the contact between the two formations being conformable but sharp (Figure 19).

Test holes in which the Winona Formation was encountered are, Test Hole AN-3, 5, 6, 8, 23, 24, 25, 32, 33, 34, 35, 36, 39, 40, 41, 42, 43, 45, 47, 48, 51, 60, 64, 65, and 66.

Zilpha Formation

Zilpha, as a term referring to geology, first appeared in the Mississippi Geological Society Guidebook 2 (1940) for the Claiborne and Wilcox field trip. Formational status was assigned to the Zilpha by Thomas (1942, p. 34) with his reasoning being: "1. It is a distinctive lithological unit which can be traced without serious interruption across the State of Mississippi. 2. Giving it the rank of a member along with the Winona or Kosciusko would necessitate

Figure 17.—Outcrop of Winona in roadcut located in the SE/4, SE/4, Sec. 22, T.4 N., R.16 E.

Figure 18.—Winona outcrop in roadcut located in the SE/4, NE/4, Sec. 7, T.4 N., R.15 E.

Figure 19.—Winona-Zilpha contact. Leslie Gilliland walking on Winona with Zilpha at shoe-top level. Location, SW/4, SE/4, Sec. 21, T.3 N., R.18 E.

the introduction of a new formational name, since both of these terms are restricted to other divisions and should not be expanded to include the Zilpha section." As a type locality had not previously been established, Thomas did so and described it as: ". . . along the country road at Bucksnort Hill, one and half miles north of Zilpha Creek and near the center of Sec. 8, T.16 N., R.6 E., extreme northwestern Attala County, Mississippi."

In Clarke County the Zilpha Formation is a brownish-gray to greenish-gray, carbonaceous, slightly glauconitic to non-glauconitic clay, with partings of gray to brown silt and thin stringers of fine-grained sand. Exposures, upon weathering, tend to develop a chocolate brown to a dark red color. In a roadcut in the SE/4, Sec. 22, T.3 N., R.17 E., the Zilpha is displayed as a dark-gray to chocolate brown silty clay. Throughout the outcrop zone the formation is thin, being absent in places and rarely exceeding 20 feet in thickness. Test Hole AN-47 in the SW/4, NW/4, Sec. 17, T.2 N., R.15 E., encountered only 8 feet of Zilpha, whereas a water well drilled in the NW/4, SW/4, Sec. 6, T.1 N., R.18 E., encountered approximately 100 feet of Zilpha located at a depth of 202 feet to 302 feet.

The clay of the Zilpha Formation is disconformably overlain by the sand of the Kosciusko Formation (Figure 20).

Test holes in which the Zilpha was encountered are AN-3, 5, 6, 8, 22, 23, 24, 25, 30, 32, 33, 34, 35, 36, 38, 39, 40, 41, 42, 43, 45, 47, 48, 51, 60, 64, 65, and 66.

Figure 20.—Zilpha-Kosciusko contact. Hammer marks the position of the contact. Location: SW/4, SE/4, Sec. 21, T.3 N., R.18 E.

KOSCIUSKO FORMATION

Cooke (1925, p. 133-136) proposed the name Kosciusko, classified it as a member of the Lisbon Formation, and gave the

following description: "The name Kosciusko sandstone member is here proposed as a designation for the ledges of saccharoidal to quartzitic sandstone exposed in the vicinity of Kosciusko, the county seat of Attala County, Miss., and for the unconsolidated sands of the same age in Mississippi. The name 'Decatur sand,' being preoccupied, will be dropped."

Thomas (1942, p. 40) redefined the Kosciusko "to include all beds above the Zilpha shale and below the Wautubbee (Cook Mountain) formation" and raised the Kosciusko to the rank of formation.

The Kosciusko Formation in Clarke County chiefly consists of fine- to medium-grained sand, minor coarse-grained sand, clayey silts and silty clays, with carbonaceous to lignitic material and lignite in varying quantities being present throughout the unit. Clay is also present in the sand as pellets, balls, partings, stringers, irregular inclusions and lenses (Figure 21). Associated with the materials are depositional features such as cross-bedding, cut-and-fill, and reworked silts and clays. Depicted, by outcrops, is the

Figure 21.—Road cut exposure of sands of the Kosciusko Formation. Location is in Sec. 4, T.3 N., R. 17 E. Energy Lookout Tower in background.

extreme lenticular nature of the various lithologies (Figure 22). Color, when fresh, is light-gray to gray to black, with the darker colors being influenced by the presence of carbonaceous and/or lignitic material. Also, greenish-gray, brownish-gray and light-brown are common colors. When exposed, or located at sufficiently shallow depths to be within the zone of intense weathering, yellows, oranges, and reds predominate. Thickness of the formation varies from 0 along the north side of the outcrop zone to a maximum of 167 feet in Test Hole AN-22 in the NW/4, NE/4, Sec. 26, T.2 N., R.15 E. Minimum thickness of the Kosciusko Formation encountered in a test hole was 90 feet in Test Hole AN-35 in the SE/4, SE/4, Sec. 7, T.2 N., R.18 E. Thickness of the Kosciusko Formation is usually on the order of 130 feet.

Figure 22.—Clays, silts and sands of the Kosciusko Formation in the roadcut of airport road in Sec. 22, T.3 N., R.15 E.

The outcrop zone of the Kosciusko Formation is of a major proportion, comprising approximately 23 percent of Clarke County. Excellent exposures are numerous and can be observed along State Highway 514 east of Enterprise to about 5 miles east of U. S.

Highway 45. Also, along U. S. Highway 45 from the Lauderdale-Clarke County line south to approximately 2 miles north of Quitman. Many additional equally interesting exposures are present from the northwestern area to the east central area of Clarke County.

The Kosciusko Formation is separated from the overlying Cook Mountain Formation by a disconformity. Figure 23, a photograph of a road cut in the SW/4, NW/4, Sec. 21, T.4 N., R.15 E., shows the disconformable nature of the sands of the Kosciusko and the fossiliferous, sandy clays and clayey sands of the Cook Mountain. A ferruginous ledge marks the contact between the Kosciusko Formation and the Cook Mountain Formation at this locality. The contact between the Kosciusko and Cook Mountain as it appears along State Highway 18 in Sec. 21, T.3 N., R.17 E., near the abandoned Hopewell School, is shown in Figure 24.

Although DeVries (1963, p. 15) did not locate definite marine Kosciusko deposits in Jasper County, he did note the trend toward a marine environment in the statement, "The presence of

Figure 23.—Kosciusko-Cook Mountain Contact. Ferruginous ledge on which Leslie Gilliland is standing marks the contact. Location is a roadcut in the SW/4, NW/4, Sec. 21, T.4 N., R.15 E.

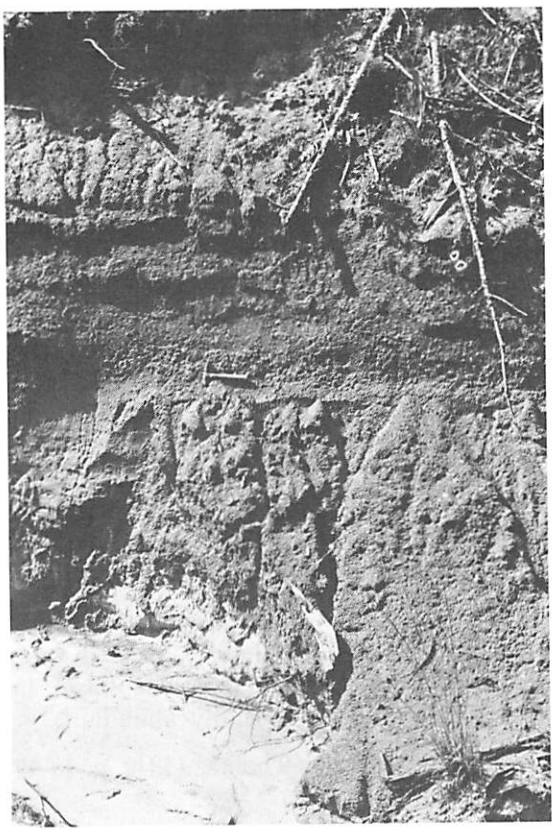

Figure 24.—Kosciusko-Cook Mountain contact. The hammer is located at the contact between the underlying sand of the Kosciusko and the sandy clays of the overlying Cook Mountain. Location is in Sec. 21, T.3 N., R.17 E.

glauconite in the upper part of the Kosciusko suggests marginal-marine conditions at the close of deltaic deposition."

In Clarke County the uppermost Kosciusko was fossiliferous at one outcrop, a bluff, located along the Chickasawhay River in the NW/4, Sec. 18, T.2 N., R.16 E. Further, the uppermost Kosciusko was fossiliferous in Test Holes AN-8, 23, 51, and 52.

Through the outcrop belt of the Kosciusko no attempt was made to map separately the Kosciusko sands and the terrace sands; this was due to their great similarity in appearence and lithology.

Test holes in which the Kosciusko is present are Test Holes AN-2, 3, 6, 8, 21, 22, 23, 24, 25, 32, 33, 35, 38, 39, 40, 41, 42, 43, 45, 47, 48, 50, 51, 52, 53, 54, 55, 58, 63, 64, 65, and 66.

Cook Mountain Formation

Cook Mountain as a term with geologic connotation first appears in the Texas Geological Survey Third Annual Report of 1892 by W. Kennedy in reference to Cook Mountain, Houston County, Texas (Childress, 1973, p. 40-41). Equivalent strata in Mississippi were termed Wautubbee marls for the area near Wautubbee Station, on the Southern Railroad, in northwestern Clarke County by Lowe (1919, p. 78-79). In his original definition Lowe states: "The Wautubbee Marls constitute the most extensive division of the Lisbon, since other members of the formation have unimportant outcrops. The Wautubbee beds are all marine, consisting of highly calcareous and fossiliferous marls, of gray to almost white color, or of darker bluish and greenish tints, due to the presence of glauconite.

"The Wautubbee marls are locally rich in marine fossils, exhibiting a very characteristic fauna. The large saddle-shaped oyster, *Ostrea sellaeformis*, is especially abundant."

This unit was subdivided by Thomas (1942, p. 48-49), into three members:

Gordon Creek Shale member (top)
Potterchitto member
Archusa Marl member (bottom)

Cook Mountain is utilized in this paper instead of Wautubbee with the reasoning being: Cook Mountain is used on the Geologic Map of Mississippi and the listing of Wautubbee as an "abandoned term" by Childress (1973, p. 151-152).

Archusa Marl Member

The Archusa Marl is the lower member of the Cook Mountain Formation with its type locality having been established by Thomas (1942, p. 49-51). He stated:

"The name Archusa is taken from Archusa Springs, a well-known locality and former health resort on the Chickasawhay River south of the town of Quitman, Clarke County, Mississippi. . . .

"Characteristic Archusa lithology is well exposed at the locality selected as the type, which is a bluff beneath the south end of the bridge across the Chickasawhay River on Highway U. S. 45 two miles south of Quitman. (SW., SE., Sec. 14, T.2 N., R.15 E.). The top of the measured section is 1.0 foot below the road level, Elevation 222 feet.

SECTION AT TYPE LOCALITY OF ARCHUSA MEMBER

	Feet	Feet
Archusa marl member of Wautubbee formation, neither contact exposed		48.0
Marl or soft limestone, light-gray to white fossiliferous sandy and glauconitic	1.5	
Marl, light-gray to white fossiliferous sandy and sparingly glauconitic; abundant irregular clay inclusions; less indurated than bed above; scattered weathered pyritiferous concretions; abundant *Ostrea sellaeformis* and other fossils in the basal foot	3.5	
Limestone, light-gray sandy glauconitic and fossiliferous; forms lip of small falls	1.5	
Marl, similar to 3.5-foot bed above; *Ostrea sellaeformis* and many other forms	10.5	
Oyster bed, dark-green medium-grained greensand with an abundance of *Ostrea sellaeformis* and communited shells	1.0	
Marl, similar to 10.5-foot bed above	8.0	
Limestone, discontinuous ledge of material similar to that above and below but slightly more indurated	1.0	
Marl, similar to 10.5-foot bed above	21.0	

Base of section—low water level of Chickasawhay River"

Test Hole AN-58, located in the SW/4, SE/4, Sec. 14, T.2 N., R.15 E., at an approximate elevation of 240 feet, was cored /drilled south of the Chickasawhay River on old Highway 45 at the type locality of the Archusa Marl member of the Cook Mountain Forma-

tion. In Test Hole AN-58 the base of the Archusa Marl is at an elevation of 164 feet. Thomas (1942, p. 49-51) described 48 feet of Archusa Marl in which neither contact was exposed. The elevation of the top of the section was 221 feet and the bottom of the section measured by Thomas was at an elevation of 173 feet. Thus the Archusa Marl extends approximately seven feet below the section measured by Thomas. Further, in Test Hole AN-58, 17 feet of material was present that could be considered Potterchitto by the writer. (Note: No samples or driller's log were available for the upper 5 feet of Test Hole AN-58.) Present in the ditch of the road in the SW/4, SW/4, SE/4, Sec. 14, T.2 N., R.15 E., at the road intersection approximately 600 feet south of the type locality of the Archusa Marl is the Gordon Creek Shale at an elevation of 250 feet.

Test Hole AN-8, located in the NW/4, NE/4, Sec. 23, T.2 N., R.15 E., was drilled approximately one-quarter mile south of the Archusa Marl type locality. In Test Hole AN-8 there was 57 feet of Archusa Marl overlain by 18 feet of greenish-gray, fossiliferous, glauconitic, silty clay of the Potterchitto member.

Doby's Bluff, located in the E/2, NW/4, Sec. 18, T.2 N., R.16 E. on the Chickasawhay River, forms an outcrop with a vertical exposure of approximately 100 feet. The Archusa Marl member comprises the major part of the bluff and disconformably overlies the Kosciusko Formation (Figure 25). (Note: Test Hole AN-63 was drilled/cored at a distance of approximately 75 feet back from the bluff face.)

The Archusa Marl member is essentially as the name indicates, a marl, light-gray to greenish-gray to brownish-gray, clayey to sandy, fossiliferous, glauconitic, and partially indurated. Thin discontinuous limestone lenses are present at various positions within the unit.

Upon weathering and leaching the Archusa Marl develops a dark-red, sparingly glauconitic, clayey sand. Where deeply weathered the Archusa Marl may actually resemble the weathered sands and clays of the Kosciusko Formation, making for difficulty in distinguishing between the two units.

The outcrop belt of the Archusa Marl member extends from the northwestern corner of Clarke County, trending in an east-southeast direction to the Mississippi-Alabama State Line in T.2 N., R.18 W. Exposures are present in the cuts at the municipal

Figure 25.—Doby's Bluff. Archusa Marl overlying clays of Kosciusko Formation. Location, E/2, NW/4, Sec. 18, T.2 N., R.16 E., on the Chickasawhay River. Photograph by David T. Dockery III.

airport north of Quitman and capping the hills along State Highway 513 from Sec. 15, T.3 N., R.15 E., north to Sec. 9, T.3 N., R.15 E., between Quitman and Stonewall. Shown in Figure 26 is a weathered outcrop of the Archusa Marl located in the NW/4, SW/4, Sec. 10, T.3 N., R.15 E.

Maximum thickness of the Archusa Marl encountered in Clarke County was 60 feet in Test Holes AN-2 and 23 located, respectively, in the NW/4, NW/4, Sec. 17, T.2 N., R.14 E., and the SE/4, Sec. 8, T.2 N., R.16 E. The minimum thickness of the Archusa Marl was 45 feet in Test Hole AN-3, located in the SE/4, NW/4, Sec. 3, T.3 N., R.14 E.

The contact between the Archusa Marl member and the Potterchitto is conformable and gradational.

Test holes in which material of the Archusa Marl member was present are AN-2, 3, 8, 21, 22, 23, 24, 35, 39, 42, 43, 45, 47, 48, 50, 51, 52, 53, 54, 55, 58, 63, and 65.

Figure 26.—Weathered Archusa Marl with poorly preserved fossils. Location NW/4, SW/4, Sec. 10, T.3 N., R.15 E.

Potterchitto Member

Potterchitto, as a geological term, dates from 1942 when Thomas (1942, p. 57) subdivided the Cook Mountain into three members, naming the middle unit Potterchitto from the creek of the same name. The type locality is defined as "a series of roadcuts along the Newton-Decatur highway (State Highway 15) on the south valley wall of the creek about two miles northeast of the town of Newton (NE.¼, Sec. 26 and SE.¼, SE.¼, Sec. 23, T.6 N., R.11 E.)."

A series of grayish-yellowish-green to light-greenish-gray to dark-greenish-gray and gray, glauconitic, fossiliferous strata of very-fine- to fine-grained sand, clay, and marl comprises the Potterchitto member of the Cook Mountain Formation in Clarke County. The composition of the Potterchitto varies greatly from places where it is essentially a greensand to other places where it is a sandy marl or a marly clay. In those places where glauconite is abundant in the Potterchitto member, extensive weathering provides for the development of a deep-red or dark-reddish-brown, ferruginous sand. This condition makes division of the Potterchitto member from the underlying Archusa Marl member difficult where weathering has penetrated to sufficient depth that both members have undergone considerable weathering. In some instances the division of the Potterchitto from the Archusa Marl may not be accomplished.

The Potterchitto member is relatively thin, varying in thickness from 10 feet to 21 feet. The minimum thickness of 10 feet was encountered in Test Hole AN-45, located in the SW/4, NE/4, Sec. 29, T.4 N., R.14 E., whereas the maximum thickness encountered in Clarke County was in Test Holes AN-55 and 57, located respectively in the NE/4, SW/4, Sec. 23, T.2 N., R.14 E., and NE/4, NW/4, Sec. 21, T.2 N., R.14 E.

The uppermost strata of the Potterchitto member are exposed in the railroad cut north of Wautubbee in the NE/4, NW/4, Sec. 10, T.3 N., R.14 E., at the U. S. Highway 11 overpass and the tracks of the Southern Railway.

A conformable contact separates the Potterchitto member from the overlying Gordon Creek Shale member (Figure 27).

Potterchitto strata were identified in the following test holes: Test Hole AN-2, 3, 4, 8, 19, 20, 21, 22, 23, 35, 39, 45, 47, 50, 51, 52, 53, 54, 55, 57, 63, and 65.

Gordon Creek Shale Member

Gordon Creek Shale member is the name applied to the upper clay unit of the Cook Mountain Formation (Thomas, 1942, p. 57). In his reference to the type locality he states, "The name Gordon Creek is taken from a small creek which flows through Wautubbee station and which is crossed by the Laurel-Meridian highway (U.S. 11) a short distance south of the station. The type section is designated as that shown on the profile along the highway (Profile

Figure 27.—Potterchitto-Gordon Creek Shale contact. Knife is at approximate contact. Contact is gradational. Location, NE/4, NW/4, Sec. 10, T.3 N., R.14 E., at U.S. Highway 11 overpass and tracks of Southern Railway.

B)." (Note: The area included in the type locality extends from approximately the north line of the SE/4, NW/4, SE/4, Sec. 34, T.4 N., R.14 E., south approximately 4.5 miles to a point near the southwest corner of the NW/4, SE/4, Sec. 21, T.3 N., R.14 E., Clarke County, Mississippi.)

During this investigation Test Hole AN-4 was cored through the Gordon Creek Shale approximately 300 feet south of the highway overpass where the Gordon Creek Shale is exposed (Figure 28), and within that area designated as the type locality. A description is as follows:

AN-4 (in part)

NW/4, NE/4, Sec. 10, T.3 N., R. 14 E.

Depth (feet)	Thickness (feet)	Description
13.75		Contact, Cockfield Formation above, with Gordon Creek Shale member below.
22.0	8.25	Clay, shaly, greenish-black to dark-greenish-gray, sparingly carbonaceous, micaeous; silt laminae, light-gray, micaceous.
32.0	10.0	Clay, shaly, greenish-black to dark-greenish-gray, sparingly carbonaceous, micaceous; silt laminae, light-gray to greenish-gray, micaceous.

Figure 28.—Gordon Creek Shale - Cockfield Contact. Dark-colored shales of the Gordon Creek Shale are overlain by light colored sand and clays of the Cockfield. Location is U. S. Highway 11 overpass, over Southern Railway, in Sec. 10, T.3 N., R. 14 E.

34.5	2.5	Clay, silty, laminated, dark-greenish-gray, micaceous.
34.5	20.75	Contact, Gordon Creek Shale member above, with Potterchitto member below.

The Gordon Creek Shale member is comprised of greenish-black to dark-greenish-gray, micaceous, sparingly carbonaceous, shaly clay with associated laminae of light-gray to greenish-gray micaceous silt. Weathered Gordon Creek Shale varies in color from black to chocolate brown to red to grayish-tan, depending in part upon the degree to which weathering has progressed.

Outcrops of the Gordon Creek Shale are present in the NE/4, NW/4, Sec. 10, T.3 N., R.14 E., at the U. S. Highway 11 bridge over the tracks of Southern Railway (Figure 28) and in roadcuts to the north and south of this location along U. S. Highway 11.

Thickness of the Gordon Creek Shale member in Clarke County varies, in the subsurface, from a minimum of 15 feet in Test Hole AN-47 in the SW/4, NW/4, Sec. 17, T.2 N., R.15 E., to a maximum thickness of 67 feet in a water well, Beaver Dam Water Association, in the SE/4, NE/4, Sec. 9, T.10 N., R.9 W.

Beds of the Cockfield Formation overlie and are separated from the underlying beds of the Gordon Creek Shale member by a conformable but sharp contact (Figure 28).

Encountering the Gordon Creek Shale were Test Holes AN-2, 3, 4, 18, 19, 20, 21, 22, 23, 45, 47, 50, 52, 53, 54, 55, and 57.

COCKFIELD FORMATION

It was Vaughan (1895) who applied the term Cockfield to strata cropping out near Cockfield Ferry, Louisiana. Vaughan (1896), in his publication, Geology and Paleontology of Northwestern Louisiana, stated, "Conformably above the fossiliferous Lower Claiborne at St. Maurice, . . . are laminated nonfossiliferous clays or laminated sand and clay, . . . the same beds are well exposed at Cockfield Ferry, about halfway between St. Maurice and Montgomery . . .

"At Montgomery, immediately below the Jackson, beds lithologically like those found in the upper part of the St. Maurice section and like those at Cockfield Ferry are found.

"For those beds between St. Maurice and Montgomery, coming between the Lower Claiborne and the Jackson, I propose the local name of 'Cockfield Ferry beds'."

Cockfield was introduced to the Mississippi literature by Lowe (1915, p. 77) when he wrote, "In the uppermost part of the Lisbon the marls give place to lignitic clays and lignites. This phase of the formation is sufficiently persistent to justify its consideration as a distinct member under the name of the Cockfield Lignite. This name was given to the Claiborne outcrops at Cockfield Ferry, Louisiana, and the characteristic clays and lignite extend across Louisiana and have been encountered at several points in Mississippi, probably extending into Alabama."

The Cockfield Formation in Clarke County is comprised of massive fine-grained sands, clayey silts, silty shales, and carbonaceous to lignitic beds. Generally, the lower part of the unit is more sandy, being essentially fine-grained, silty, clayey, micaceous, light-gray to medium-gray in color, and with carbonaceous to lignitic material present. The upper part of the unit, in contrast, contains a greater abundance of zones of laminated, highly carbonaceous to lignitic beds and lenses, or thin beds of fine-grained, micaceous, sands, silts, and clays. Color, when fresh, varies from tan, light-gray to dark-gray, and chocolate brown, whereas weathering

imparts contrasting banded or mottled colors with the more pervious sands and silts producing a yellow-orange to orange-brown and the clays becoming light-tan to buff.

The Cockfield Formation crops out in an area extending from the southeastern part of Clarke County to the west-central part of the county, trending in a southeast to northwest direction. The outcrop zone of the Cockfield Formation occupies approximately 21 percent of Clarke County. Throughout the outcrop belt of the Cockfield Formation exposures are present in the form of roadcuts and other excavations. Exposures of the formation are well displayed along State Highway 18 and 511 east of Quitman. Shown in Figure 29 is an outcrop of the Cockfield Formation located in the SW/4, SW/4, Sec. 6, T.2 N., R.16 E., in which the sand of the lower

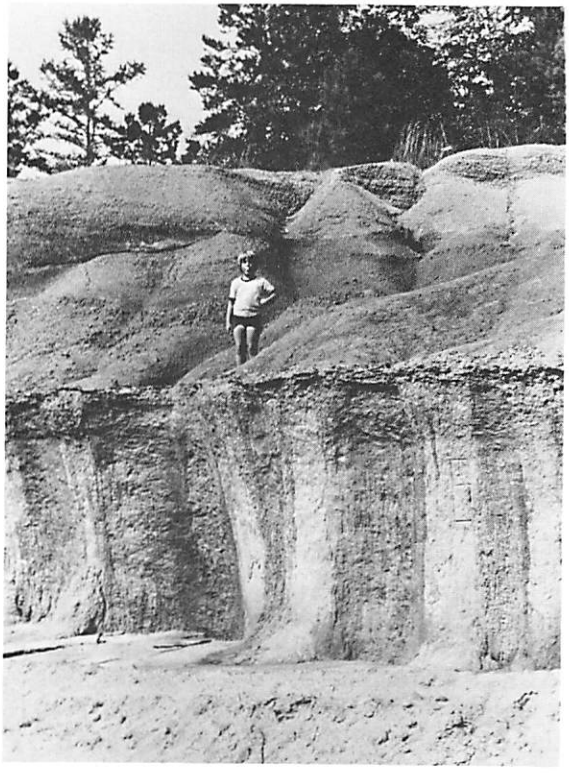

Figure 29.—Sand of the lower Cockfield overlain by lignitic, silty clay of the upper Cockfield. Leslie Gilliland standing at contact between lower and upper units of the formation. Location: SW/4, SW/4, Sec. 6, T.2 N., R.16 E.

Cockfield and the lignitic, fine-grained sand, silt, and clay of the upper Cockfield are present. An outcrop exhibiting the banding and mottled colors produced as a result of the weathering of the sands and silts to a yellow-orange to orange-brown color and the clays to a light-tan to buff color is present in a roadcut in the NW/4, SW/4, Sec. 6, T.2 N., R.16 E. (Figure 30).

Figure 30.—Outcrop of Cockfield located in NW/4, SW/4, Sec. 6, T.2 N., R.16 E., displaying banding and mottled appearance due to weathering of the sand and silts and clays developing different colors and shades.

Downdip from the outcrop zone the Cockfield Formation in Clarke County varies in thickness from a minimum of 76 feet in Test Hole AN-52, located in the NE/4, NW/4, Sec. 27, T.1 N., R.17 E., to a maximum of 112 feet penetrated in Test Hole AN-19, located in the NE/4, SE/4, Sec. 22, T.1 N., R.15 E.

The lignitic sand, silt, and clay of the Cockfield Formation is separated by a disconformity from the overlying fossiliferous greensand, glauconitic sand and marl of the Moodys Branch Formation.

Cockfield deposits were encountered in Test Holes AN-2, 4, 17, 18, 19, 20, 21, 22, 23, 46, 49, 50, 52, 53, 54, 55, 56, and 57.

JACKSON GROUP

Conrad (1855) used the term Jackson for beds of fossiliferous marl that crop out near Jackson, Mississippi. Hilgard (1860, p. 130-131), gives the description, "The following general section, deduced from observations at Moody's branch and in the McNutt Hills, 1 to 2 miles N.E. of Jackson, will best illustrate the condition of things in this neighborhood." Hilgard (1860, p. 134) further states, "In

SECTION OF JACKSON STRATA, AT MOODY'S BRANCH AND McNUTT HILLS.

FEET.	CHARACTER OF STRATA.
30 to 45	Yellowish-white marl, more or less sandy, sometimes indurate and forming a soft rock; gives rise to "bald prairies" in the McNutt Hills. Contains bones of *Zeuglodon*, vertebrae and teeth of fish, *Echinus!*, *Scutella*, *Hemiaster?*, and casts of univalves and bivalves of the Jackson Group.
6 to 10	Yellowish white, clayey marl, with few fossils—*Pecten nuperus*, *Pinna*, *Ostrea*.
8	Coarse yellow sand, somewhat clayey, with "Jackson fossils" in a fine state of preservation.
2	Blue sand, with Jackson fossils, mostly detritus.
10	Blue sandy clay, fetid, somewhat micaceous; its upper portion filled with oddly shaped, ferrugino-siliceous concretions. No fossils.
1	Earthy Lignite.
10	Gray laminated clay, interstratified with sand, with traces of stems and leaves.

Clarke and Wayne, the Jackson Group, although its territory is diminished in width, is well and characteristically developed, and affords good opportunities for observation."

The first to identify specifically the formations within the Jackson Group was Lowe (1915, p. 78-79), when he wrote, "Coincident with these changing materials we have recognized three formations belonging to this period: 1. Yazoo Clay Marl; 2. Moody's Branch Green Marl; 3. Madison Sand." Cooke (1918, p. 192) changed the name Madison Sand to Forest Hill Sand and moved the unit from Eocene to Oligocene, thereby reducing the Jackson to two formations. A third unit, the Cocoa Sand, was added by Cooke (1933, p. 1387) for exposures near the abandoned country post office called Cocoa about 2.5 miles east of Melvin, Alabama, on the Melvin-Gilbertown road. Further, Cooke (1939), upon correlation of the Moodys Branch with the Gosport Sand of Alabama, elevated the Jackson to group status and the Yazoo to formational rank. Murray (1947, p. 1837-1839) proposed, in addition to the Cocoa Sand, the North Creek Clay, Pachuta Marl, and Shubuta Clay as members of the Yazoo Formation. Murray (DeVries, 1963, p. 97) later revised the North Creek Clay to North Twistwood Creek Clay, so that the member name and the creek name, along which the type section is located, would be the same.

Current terminology used by the Bureau of Geology is:

Jackson Group

Yazoo Formation
- Shubuta Clay member
- Pachuta Marl member
- Cocoa Sand member
- North Twistwood Creek Clay member

Moodys Branch Formation

The northern limit of the outcrop belt of the Jackson Group in Clarke County forms an irregular line from Sec. 30, T.3 N., R.14 E., along the Clarke-Jasper County Line, trending southeast to Sec. 20, T.1 N., R.16 E., then northeast to Sec. 2, T.1 N., R.16 E., then east to Sec. 8, T.1 N., R.18 E., along the Mississippi-Alabama State Line. The southern limit extends from Sec. 6, T.1 N., R.14 E., along the Clarke-Jasper County Line, trending in a southeast direction to Sec. 7, T.10 N., R.7 W., near the Clarke-Wayne County Line. The outcrop belt of the Jackson Group comprises approximately 21 percent of Clarke County.

Moodys Branch Formation

Although the unit was well known and studied much earlier, it was not until 1915 that it was named "Moody's Branch Green Marl" by Lowe (1915, p. 79). The name was derived from Moody's Branch, a tributary of Pearl River, in Jackson, Mississippi.

The Moodys Branch Formation, lowermost unit of the Jackson Group, is a light-gray to brownish-gray to greenish-gray, highly fossiliferous, glauconitic, sandy to clayey marl and marly sand. In Clarke County the Moodys Branch Formation is, in places, comprised of two units. Shown in Figure 31 is an exposure of Moodys Branch located in the SW/4, NW/4, Sec. 21, T.2 N., R.14 E., in which the lower six feet is a light-brownish-gray, fossiliferous, marly sand overlain by three and one-half feet of light-gray to brownish-gray, glauconitic, fossiliferous, clayey, sandy marl.

Figure 31. Moodys Branch Formation. Lower unit is a light-brownish-gray, fossiliferous, marly sand and is overlain by a light-gray to brownish-gray, glauconitic, fossiliferous, clayey, sandy marl, the upper unit. The vegetation line marks the approximate location of the top of the Moodys Branch Formation. Location is the SW/4, NW/4, Sec. 21, T.2 N., R.14 E.

Thickness of the Moodys Branch Formation encountered in Clarke County varies from a minimum of 10 feet, penetrated in Test Hole AN-46, located in the SW/4, SE/4, Sec. 27, T.3 N., R.14 E., to a maximum of 25 feet in a water well located in the NW/4, NE/4, Sec. 9, T.10 N., R.8 W.

The light-gray to greenish-gray, glauconitic, fossiliferous, clayey, sandy marl of the Moodys Branch Formation is separated from the overlying light-gray to light-green to dark-green blocky clay of the North Twistwood Creek Clay member of the Yazoo Formation by a gradational contact (Figure 32).

The Moodys Branch was identified in Test Holes AN-1, 2, 11, 13, 17, 18, 19, 20, 21, 46, 49, 52, 53, and 56.

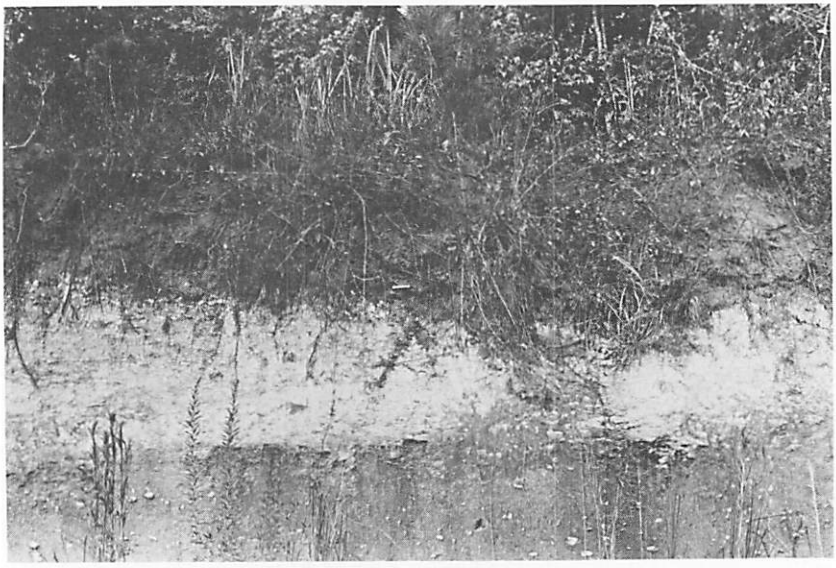

Figure 32.—Moodys Branch-Yazoo (North Twistwood Creek Clay member) contact. The knife marks the contact between the overlying clay of the North Twistwood Creek Clay member (Yazoo Formation) and the clayey, sandy marl of the Moodys Branch Formation. Location is the SW/4, NW/4, Sec. 21, T.2 N., R.14 E.

Yazoo Formation

North Twistwood Creek Clay Member

Murray (1947, p. 1839) proposed the name North Creek Clay "for an average of 40 feet of green or gray, slightly glauconitic,

fossiliferous clay, underlain by the Moodys sand and overlain by the Pachuta marl or the Cocoa sand. The type locality was designated to consist of exposures on the west side of North (Twistwood) Creek in the SW/4, of Sec. 1, T.3 N., R.12 E., Jasper County, Mississippi, 2 miles southwest of Rose Hill on the graveled state highway to Gridley and Turnersville."

In 1963 Murray (DeVries, 1963, p. 97-100) changed the name North Creek Clay to North Twistwood Creek Clay, thereby making the member name and the creek name, where the type section is located, the same.

Clays of the North Twistwood Creek Clay member in Clarke County are light-greenish-gray to green in color, slightly silty to silty, fossiliferous, slightly glauconitic, blocky, and calcareous. Upon weathering a gray to buff to orangish-brown, silty clay usually develops.

Exposures of the North Twistwood Creek Clay may be observed in numerous places throughout the outcrop belt. Two

Figure 33.—North Twistwood Creek Clay, Location, along Chickasawhay River 200 feet downstream from old bridge in the NW/4, SW/4, Sec. 32, T.1 N., R.16 E.

outcrops of the North Twistwood Creek Clay are given below. An outcrop located along the Chickasawhay River in the NW/4, SW/4, Sec. 32, T.1 N., R.16 E., is shown in Figure 33. Also, an outcrop of the North Twistwood Creek Clay located along Garland Creek in the NW/4, NW/4, Sec. 28, T.1, N., R.16 E., is shown in Figure 34.

Thickness of the member, in Clarke County, varies from a minimum of 49 feet encountered in Test Hole AN-52, located in the NE/4, NW/4, Sec. 27, T.1 N., R.17 E., to a maximum of 70 feet penetrated in Test Hole AN-18, located in the SE/4, NE/4, Sec. 34, T.1 N., R.15 E.

Figure 34.—North Twistwood Creek Clay, overlying Moodys Branch (below hammer). Location, Garland Creek, NW/4, NW/4, Sec. 28, T.1 N., R.16 E.

The contact separating the North Twistwood Creek Clay member from the overlying Cocoa Sand member or the Pachuta Marl member, based on the electric logs available, appears to be gradational. (Note: The Cocoa Sand member, in Clarke County, is a discontinuous unit.) At no place in Clarke County, Mississippi, was the contact between the North Twistwood Creek Clay and the overlying beds observed by the writer.

Test holes in which the North Twistwood Creek Clay was present are AN-1, 2, 13, 17, 18, 19, 20, 21, 46, 49, 52, 53, and 56.

Cocoa Sand Member

The Cocoa Sand was formally defined by Cooke (1933, p. 1387, 1388) after the term was used by several writers in which the only explanation given was that it was of Jackson age and that it is present at the Cocoa Post Office, Alabama. Cooke (1933, p. 1387, 1388), in his description of the type locality, stated, "The name is taken from the abandoned country post office called Cocoa that many years ago stood in the SW¼, sec. 13, T.11 N., R.5 W., Choctaw County, Alabama, about 2.5 miles east of Melvin on the road to Gilbertown." He described the Cocoa Sand, generalized for Choctaw County, Alabama, as 17 to 70 feet of fine yellow sand, partly calcareous and argillaceous, with shells in the lower part.

In Clarke County, Mississippi, the Cocoa Sand, where fresh, is a light-gray to light-greenish-gray, fossiliferous, clayey, calcareous, fine- to medium-grained sand. Weathering results in a light-brownish-yellow to light-brownish-gray, friable, fine- to medium-grained sand.

Weathered outcrops of the Cocoa Sand are present in roadcuts in the E/2 Sec. 18 and the W/2, Sec. 19, T.1 N., R.18 E. In the SW/4, NW4, Sec. 35, T.1 N., R.15 E., in the channel of Shubuta Creek a relatively fresh exposure of the Cocoa Sand is displayed (Figure 35). The above exposure on Shubuta Creek is the westernmost outcrop of the Cocoa Sand observed. Test Hole AN-18, in the SE/4, NE/4, Sec. 34, T.1 N., R.15 E., is the westernmost point to which the Cocoa Sand member was definitely identified in the subsurface.

Thickness of the Cocoa Sand ranges from 0 in the western part of Clarke County, where it is absent, to a maximum of approximately 30 feet. The maximum thickness is based on an electric log of a water well in the NW/4, NE/4, Sec. 1, T.10 N., R.6 W., Wayne

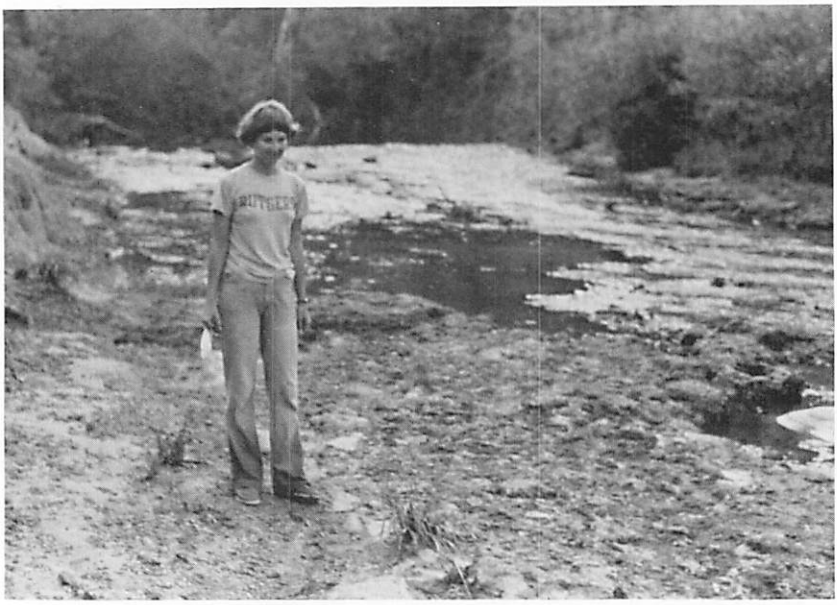

Figure 35.—Cocoa Sand exposure located in Shubuta Creek. Located in the SW/4, NW/4, Sec. 35, T.1 N., R.15 E. Dora Devery, staff geologist, standing on Cocoa Sand.

County, Mississippi. The above well is used as it is located less than one-half mile from Clarke County and as no well or test hole is present in the immediate Clarke County area.

Test holes in western Clarke County penetrating the Pachuta Marl and encountering the North Twistwood Creek Clay in which the Cocoa Sand was not present are: AN-11 in the center, S/2, Sec. 28, T.1 N., R.14 E., AN-13 in the SW/4, NE/4, Sec. 1, T.10 N., R.9 W., AN-17 in the NE/4, SE/4, Sec. 35, T.1 N., R.14 E., and the Pachuta Marl member type locality core hole in the SW/4, NE/4, Sec. 30, T.2 N., R.14 E.

The Cocoa Sand is a discontinuous unit in Clarke County, grading from a relatively thick unit, 30 feet, in the southeastern part of the county to one of a thin sand or thin sand lenses in south-central Clarke County to being absent in the western part of the county. The Cocoa Sand undergoes a facies change from east to west, with the lower part of the Pachuta Marl in southern and western Clarke County being the facies equivalent of the Cocoa Sand.

The contact between the underlying Cocoa Sand member and the Pachuta Marl member is gradational.

Test holes in which the Cocoa Sand was encountered are AN-1, 18, and 19.

PACHUTA MARL MEMBER

Murray (1947, p. 1839) proposed the name Pachuta Marl member, at which time he gave the description and type locality as ". . . 6-25 feet of buff, gray, or white, partially indurated, generally glauconitic, fossiliferous marl, overlain by the Shubuta clay and underlain by the Cocoa sand or North (Twistwood) Creek clay. . . . The type locality was designated to consist of exposures on the south side of Pachuta Creek, 1¼ mile south and southeast of Pachuta in the SW/4 of Sec. 8, T. 2N., R. 14E., Clarke County, Mississippi."

The Pachuta Marl member in Clarke County varies in composition from marly clay to clayey marl, is white to gray to buff in color, fossiliferous, glauconitic, and partially indurated. Minimum thickness of the Pachuta Marl, 10 feet, occurred in Test Holes AN-17 and AN-19. Maximum thickness encountered was approximately 25 feet in a well located in the NE/4, NE/4, Sec. 27, T.1 N., R.15 E.

Shown in Figure 36 is an outcrop of the Pachuta Marl located in the SW/4, NW/4, Sec. 14, T.1 N., R.17 E. Two other outcrops present as roadcuts are located in the SE/4, NE/4, Sec. 33, T.1 N., R.17 E., and in the SE/4, SE/4, Sec. 26, T.1 N., R.15 E.

A conformable contact separates the Pachuta Marl from the overlying Shubuta Clay.

Test holes in which the Pachuta Marl is present are AN-1, 2, 11, 13, 17, and 19.

SHUBUTA CLAY MEMBER

The uppermost member of the Yazoo Formation, Shubuta Clay, was named by Murray (1947, p. 1839), at which time he stated ". . . 20-250 feet of clays and clayey marls, underlain by the Pachuta marl and overlain by the Forest Hill sand or Red Bluff clay of the Oligocene. Exposures on the east side of the Chickasawhay River, just north of the old U. S. Highway 45 bridge east of Shubuta,

Figure 36.—Roadcut in which the Pachuta Marl is exposed. Located in the SW/4, NW/4, Sec. 14, T.1 N., R.17 E.

Clarke County, Mississippi (SW¼ of Sec. 3, T. 10N., R. 16 E.) were designated as the type locality." (Note: The range in Murray's description is given as R.16 E.; it should be R.7 W.)

In Choctaw County, Alabama, Toulmin, et al., (1951, p. 122) states, "The Shubuta member is 25 to 35 feet thick, and resembles somewhat the North (Twistwood) Creek member. It consists of light greenish-gray and white highly calcareous clay which weathers to light grayish-yellow to white. It contains many small irregular white lime concretions, and in most places it is a white chalky calcareous clay or clayey limestone."

DeVries (1963, p. 29), in reference to Jasper County, Mississippi, wrote, "Measured sections of the Shubuta clay member interval ranged from 100 to 216 feet in thickness; however, these figures may not approach probable extremes of thickness of the member." Further, he states, "The Shubuta clay lithology of Jasper County includes light-green to greenish-gray, calcareous to non-calcareous, glauconitic, fossiliferous, silty clays."

For Wayne County, Mississippi, May (1974, p. 49-50) gives the following, "The lithology of the Shubuta in Wayne County, Mississippi, is mainly a light-olive-gray to yellowish-gray, calcareous, fossiliferous clay." He lists the thickness as having a range of 34 to 92 feet.

The Shubuta in Clarke County is a light-green to light-grayish-green, fossiliferous clay, which upon weathering develops yellowish or very light-gray to white, heavy, blocky, sticky clay, with selenite crystals and white to buff, calcareous nodules. The Shubuta occupies the part of the county from the south central region along the Jasper-Clarke County line east to the southeast corner of the county. Outcrops of the Shubuta Clay member may be viewed along the county road along the north boundary of Sections 4, 5, and 6, T.10 N., R.6 W., east of Shubuta, Mississippi, and along the county road through Sections 6, 5, and 9, T.1 N., R.14 E., west-northwest of Shubuta. Shown in Figure 37 is an exposure of the Shubuta Clay displayed in a gully in the SW/4, SW/4, Sec. 3, T.9 N., R.7 W. Calcareous nodules which have developed with the weathering of the Shubuta Clay are shown in Figure 38 as displayed along the county road located on the southern border of Sec. 36, T.1 N., R.16 E., and Sec. 31, T.1 N., R.17 E.

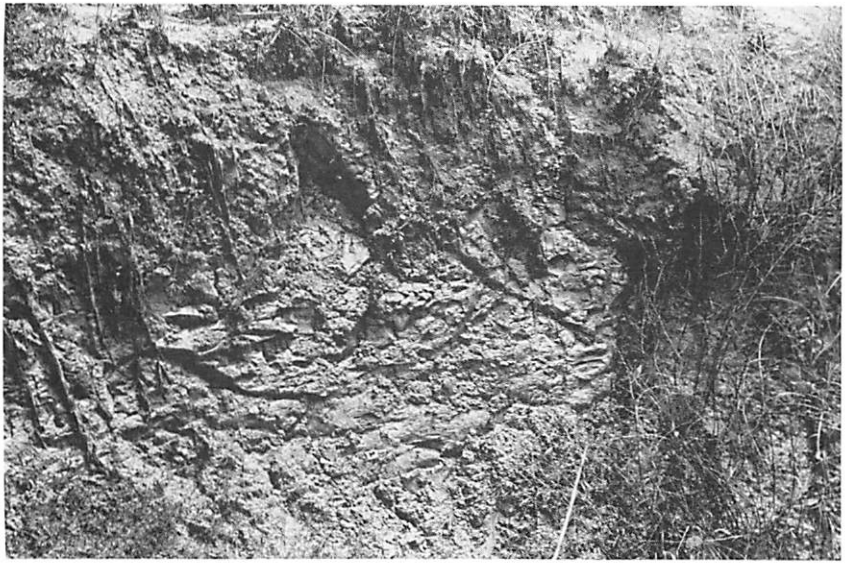

Figure 37.—Exposure of Shubuta Clay in a gully. Location, SW/4, SW/4, Sec. 3, T.9 N., R.7 W., type locality.

Figure 38.—Calcareous nodules developed by weathering of the Shubuta Clay. Location, Sec. 36, T.1 N., R.16 E., and Sec. 31, T.1 N., R.17 E.

The maximum thickness of the Shubuta Clay member encountered in Clarke County was in Test Hole AN-11 in the center, S/2, Sec. 28, T.1 N., R.14 E. One hundred twenty-eight feet of light-green to light-greenish-gray, fossiliferous clay was penetrated between the gray to dark-greenish-gray, nonfossiliferous to abundantly fossiliferous, partly marly clay of the Red Bluff Formation and the light-gray, marly, fossiliferous, glauconitic clay of the Pachuta Marl member.

Hendy (1948), in referring to the Red Bluff Formation-Shubuta Clay member outcrop located in the SW/4, Sec. 29, T.7 N., R.10 W., Wayne County, Mississippi, wrote ". . . that the contact with the Shubuta member of the Yazoo formation is disconformable. In unweathered outcrops (Stop 9) the contact between the olive-green, non-glauconitic clay and the glauconitic clay is quite evident. Small borings filled with glauconitic clay penetrated the upper few inches of the underlying bed. Whatever lapse of time is involved, there is no evidence of erosion at this contact." May (1974, p. 51) in his

study of Wayne County concluded that the contact between the Shubuta Clay member and the Red Bluff Formation is disconformable.

In Choctaw County, Alabama, Toulmin, et al., (1951, p. 122) in referring to the Red Bluff Formation-Shubuta Clay member contact states, "The light-gray Shubuta member of the Yazoo clay is overlain with apparent conformity by a yellowish marl, the basal bed of the Red Bluff clay of the Oligocene series."

In Jasper County the contact between the Red Bluff Formation and the Shubuta Clay member is reported as being conformable and transitional (DeVries, 1963, p. 34). DeVries further states, "This contact is probably conformable on a regional scale except for local diastemic interruptions. . . . "

At no place in Clarke County was the contact between the Shubuta Clay member and the Red Bluff Formation observed by the writer. Slumping of the Shubuta Clay generally produces a condition where the contact is covered by materials of the Red Bluff Formation. Based on a pronounced color change in the test hole cuttings the writer is of the opinion that the contact separating the overlying Red Bluff Formation from the Shubuta Clay member is probably disconformable.

In Test Holes AN-1, 11, 13, 16, 17, and 19 the Shubuta Clay was present.

OLIGOCENE SERIES

RED BLUFF FORMATION

In reference to the deposits presently bearing the name Red Bluff, Hilgard (1860, p. 135) had the following to say, "On the highest points in the plantation, we observe fragments of a fine-grained ferruginous rock containing a few white fossils, not represented in the Jackson Group. In passing thence toward Red Bluff Station, on the M. & O. R.R., we remain on a level with this hilltop, and at several points, high precipitous bluffs come in close to the river. At a point about a mile from the Stn., a bluff about 70 feet high, coming down in terraces to the waters edge, affords the following profile:

SECTION OF TERTIARY NEAR RED BLUFF STATION, WAYNE CO.

FEET.	CHARACTER OF STRATA.
12	First terrace—surface materials only visable.
4	Greenish, non-effervescent clay.
4	Irregular masses of fine-grained ferruginous rock, imbedded in a brownish or greenish clayey mass; both with well preserved fossils.
52	Bluish calcareous clay, with indistinct fossils. It is least calcareous, and most clayey, above; near the waters edge, approaches in character to the blue marl in Trotter's field. A fragment of a *Clypeaster*, vertebrae of a shark, *Pleurotoma* sp.

He further states, "The fossiliferous bed No. 2 of the preceding section seems to stand intermediate, by position as well as by its fossils, between these two groups, though on the whole, it seems in its fauna to approach more nearly the Vicksburg, than the Jackson Group. . . ."

Lowe (1925) writes of the Red Bluff, "In the banks of the Chickasawhay River near Hiwannee, the river bluffs expose beds of fossiliferous marls and clays. . . . These beds, exposed to a thickness of 60 feet, consist of greenish-gray joint clay, with a few large well-preserved shells near the water's edge. Eight or ten feet above low water they pass into a zone two feet thick of reddish weathered marl, full of small fossil shells, mostly gastropods. Gray or purplish clays weathering red extend to the top of the hill."

Devries (1963, p. 33) in referring to the Forest Hill and Red Bluff Formations in Jasper County stated, "Electrical logs and drilling samples show the intertonguing of the Forest Hill and Red Bluff formations in western Jasper County." Further, he gives the Forest Hill as consisting of massive cross-bedded or thin-bedded gray sands, argillaceous sands, and light-gray to yellow silty clays, with mica flakes and lignite being important constituents of the formation, which varies in thickness from 0 to 120 feet. In

reference to the Red Bluff Formation, DeVries (1963, p. 31) stated, "Two facies of the Red Bluff formation are known in Jasper County: 1) mostly non-marine, deltaic or inter-distributary clays and silty clays, and 2) marine, pro-deltaic or 'lagoonal', fossiliferous clays and marly clays.

"Non-marine (or marginal-marine) facies crop out in the central part of the County and to the north, and northwest, of this....

"Fossiliferous, marine counterparts of the deltaic facies, described above, extend southeastward from Bay Springs to the south-central part of the County, thence northeastward and, finally, north-northeast through the Paulding area. . . .

"Measured thicknesses of the Red Bluff formation (Jasper County) ranged from 18 feet on the northwest (in Test Hole JO) to perhaps 120 feet (in Test Hole JC), one mile west of Bay Springs. All samples from Test Hole JC, in the interval between the Marianna formation and the Shubuta clay member, were regarded as typical of marine Red Bluff facies of other localities. . . ."

May (1974, p. 52), in referring to the Red Bluff-Forest Hill Formations in Wayne County, Mississippi, stated, ". . . the section designated as the Red Bluff Formation is based on the 20 to 30 foot thick marine section as originally described by Hilgard.... the section designated as the Forest Hill Formation in Wayne County is considerably more marine in character than the Forest Hill to the west, and that at various intervals it contains tongues of marine material very similar to that in the specified Red Bluff Formation."

In the present study the writer treats that interval located between the Shubuta Clay member and the Mint Spring Formation as a single unit, the Red Bluff Formation. The basis for this is 1) the unit is essentially a clay throughout, containing only a few very minor sand stringers in the upper one-half, 2) fossils, although more abundant in the lower 20 feet, are present throughout the section, and 3) no definite contact was found upon study of the "Red Bluff-Forest Hill" core, taken at the Red Bluff type locality in the SE/4, SE/4, SE/4, Sec. 24, T.10 N., R.7 W., Wayne County, Mississippi. The above core was taken by J. May in 1972 and is on file at the Bureau of Geology.

In Clarke County the Red Bluff Formation is a light-gray to gray, rarely greenish-gray, partly marly, fossiliferous, silty clay.

Minor lenses of silt and very fine-grained sand occur in the upper one-half of the section. Although rare, carbonaceous material is present. Upon weathering, a mottled gray, red and brown, silty to slightly sandy clay with ferruginous nodules develops. The presence of the nodules aids greatly in the identification of the Red Bluff Formation from the underlying Shubuta Clay member.

The Red Bluff outcrop belt with the exception of the higher elevation in Section 1, 2, 3, 10, 11, and 12, T.10, N., R.7 W., is restricted to the southern part of Clarke County located west of the Chickasawhay River. The outcrop is bounded on the north by an irregular imaginary line from Sec. 7, T.1 N., R.14 E., at the Clarke-Jasper County Line, trending southeast to Sec. 7, T.10 N., R.7 W., at the Clarke-Wayne County Line, and on the south by a like line extending from Sec. 7, T.1 N., R.14 E., along the Clarke-Jasper County Line to Sec. 17, T.10 N., R.8 W., along the Clarke-Wayne County Line. Exposures are present in the form of roadcuts along the east-west county road from the W/2, Sec. 7, T.10 N., R.7 W., to the NW/4, Sec. 11, T.10 N., R.8 W. (Figure 39); along the gravel road trending in a west-northwest direction from the SW/4, SW/4,

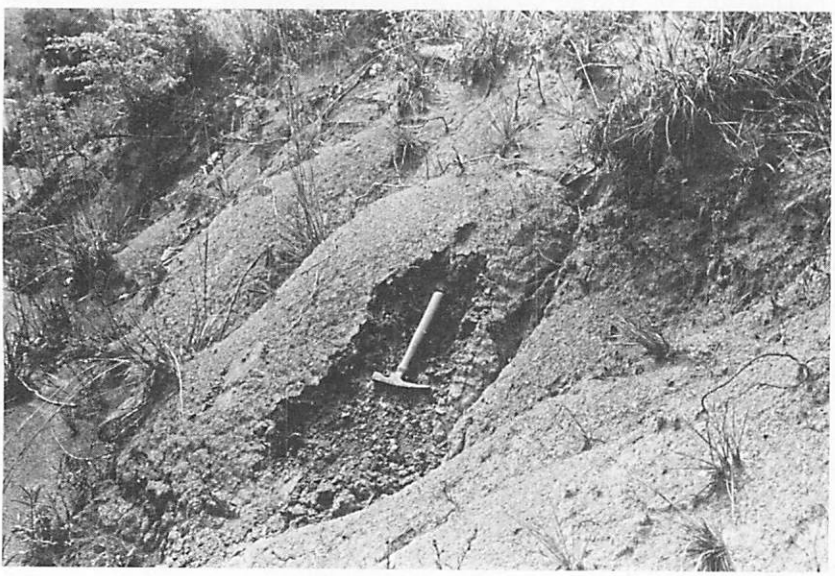

Figure 39.—Exposure of Red Bluff Clay in a ditch located in the NW/4, Sec. 11, T.10 N., R.8 W.

Sec. 1, T.10 N., R.8 W., to the SW corner of Sec. 27, T.1 N., R.14 E.; and along the unimproved roads and transmission line in Sec. 13, T.10 N., R.8 W. (Figure 40).

Thickness of the Red Bluff Formation varies from a minimum of 110 feet in Test Hole AN-13, located in the SW/4, NE/4, Sec. 1, T.10 N., R.9 W., to a maximum of 124 feet in Test Hole AN-16, located in the SW/4, NE/4, Sec. 30, T.1 N., R.14 E.

Although not observed at the outcrop, a disconformity separates the Red Bluff Formation from the overlying Vicksburg Group.

Test Holes which encountered or penetrated the Red Bluff Formation are AN-11, 13, 14, 15, 16, and 17.

Figure 40.—Exposure of Red Bluff Clay located along a transmission line in the NE/4, NE/4, Sec. 13, T.10 N., R.8 W.

VICKSBURG GROUP

Conrad (1846a) was apparently the first to note the marine strata at Vicksburg, Mississippi, in his paper, "Observations on the Eocene Formation of the United States, with descriptions of species

of shells, etc., occuring in it." (Note: At this time, 1846, the Tertiary was as originally divided by Lyell, with only three epochs, Eocene, Miocene and Pliocene. In 1854 Beyrich (Harbaugh, 1968) proposed the term Oligocene and in 1874 Paleocene was proposed by Schimper (Harbaugh, 1968). In another paper, later that year, Conrad (1846b) indicated that the Vicksburg beds occupied a distinct time intermediate to the Eocene and Miocene Formations, and used the term Vicksburg group.)

The Vicksburg Group, under the present usage of the Bureau of Geology, is composed of five formations. These are, in descending order: Bucatunna Formation, Byram Formation, Glendon Formation, Marianna Formation, and Mint Spring Formation.

The Vicksburg Group in Clarke County is present only in the southwestern part and outcrops are few.

Mint Spring Formation

Mint Spring was first used as a geologic term by Cooke (1918, p. 187) as a member of the Marianna. The name was taken from Mint Spring Bayou, which flows into Centennial Lake south of Vicksburg National Military Park, Vicksburg, Mississippi. At the type locality the Mint Spring was described by Lowe (1919, p. 89) as a soft, gray, fossiliferous marl, 10 to 12 feet thick. DeVries (1963, p. 38) in referring to the Mint Spring in Jasper County, stated, "The Mint Spring is considered of formational rank since it is an established, areally extensive, mappable unit of divergent lithic facies. . . ."

The Mint Spring is a light-gray, light-bluish-gray, light-yellowish-gray, fossiliferous, glauconitic, clayey to sandy marl with indurated limestone streaks. Upon weathering, a mottled, yellowish-gray to reddish-brown to red clay to clayey sand develops.

Thickness of the formation varies from a minimum of 9.5 feet in Test Hole (core) AN-61, located in the SW/4, SW/4, Sec. 28, T.1 N., R.14 E., to a maximum of 20 feet in Test Holes AN-13 and AN-15, located respectively in the SW/4, NE/4, Sec. 1, T.10 N., R.9 W., and SW/4, NW/4, Sec. 13, T.10 N., R.9 W.

Test holes in which the Mint Spring Formation was recognized are AN-11, 13, 14, 15, 16, 61, and 62.

Marianna Formation

Johnson (1892) first used the term Marianna for a soft,

orbitoidal limestone quarried at Marianna, Jackson County, Florida.

In Clarke County, Mississippi, the Marianna consists of a light-gray to light-bluish-gray to yellowish-brown, clayey, sandy, fossiliferous, glauconitic marl and limestone. An outcrop of the Marianna Formation is present in the SE/4, SW/4, Sec. 8, T.10 N., R.9 W., where 18.5 feet of white to gray, fossiliferous marl and concretionary limestone can be seen in a cut formed when the gravel road to the Shell Oil Company Goodwater Plant was built (Figure 41).

Thickness of the Marianna Formation in Clarke County is from a minimum of 10 feet in Test Hole AN-61, located in the SW/4, SW/4, Sec. 28, T.1 N., R.14 E., to a maximum of 24 feet in Test Hole AN-14, located in the SE/4, NE/4, Sec. 16, T.10 N., R.9 W.

The contact between the Marianna Formation and the overlying Glendon Formation is conformable. However, in Test Hole AN-13, located in the SW/4, NE/4, Sec. 1, T.10 N., R.9 W., the Marianna is overlain by the sand and gravel of the Citronelle Formation.

Test holes in which the Marianna was encountered are AN-13, 14, 15, 16, and 61.

Figure 41 —Limestone of the Marianna Formation exposed in the SE/4, SW/4, Sec. 8, T.10 N., R.9 W.

GLENDON FORMATION

The term Glendon was introduced to the geologic literature by Cooke (Hopkins, 1917) for an 18- to 20-foot thick series of ledges of hard, partly crystalline, yellowish or pinkish limestone interbedded with softer strata of impure limestone, located along the Southern Railway near Glendon, Alabama. In 1923 Cooke raised the Glendon from the rank of member to the rank of formation.

The Glendon Formation in Clarke County, Mississippi, is composed of white to light-gray to yellowish-brown, fossiliferous, clayey to sandy marl and limestone. Approximately 10 feet of hard, gray, fossiliferous limestone of the Glendon Formation overlies the Marianna Formation in the roadcut located in the SE/4, SW/4, Sec. 8, T.10 N., R.9 W. (Figure 41). The Marianna-Glendon contact is located about one foot above the "grass line" and the Glendon is covered by grass and brush in the figure.

The maximum thickness of the Glendon Formation encountered in Clarke County was in Test Hole AN-15, located in the SW/4, NW/4, Sec. 13, T.10 N., R.9 W., where 18 feet of limestone of the Glendon was penetrated.

In Test Hole AN-14, located in the SE/4, NE/4, Sec. 16, T.10 N., R.9 W., the Byram overlies the Glendon. In Test Holes AN-15 and 61, located respectively in the SW/4, NW/4, Sec. 13, T.10 N., R.9 W., and SW/4, SW/4, Sec. 28, T.1 N., R.14 E., the Bucatunna overlies the Glendon. In Test Hole AN-16, located in the SW/4, NE/4, Sec. 30, T.1 N., R.14 E., the Citronelle overlies the Glendon. In Test Hole AN-13, located in the SW/4, NW/4, Sec. 1, T.10 N., R.9 W., the Citronelle overlies the Marianna. Therefore, the Glendon underwent considerable erosion, in places, prior to the deposition of the Bucatunna and Citronelle Formations. Thus the minimum thickness of the Glendon is 0 along that edge where erosion removed it prior to the deposition of the overlying Bucatunna or Citronelle Formation.

Test holes in which the Glendon was present are AN-14, 15, 16, and 61.

BYRAM FORMATION

Casey (1901) first used the term Byram as a stratigraphic term when he referred to the fossiliferous marl exposed along the Pearl River at Byram, Hinds County, Mississippi. DeVries (1963, p. 41) in

referring to the Byram stated, "Since the unnamed 'marl member' has been repeatedly referred to as the 'Byram Marl,' the purposes of nomenclature might best be served by elevating the 'marl member' to formational status. . . ."

The Byram Formation in Clarke County is composed of a greenish-gray, clayey, glauconitic marl. The Byram was present only in Test Hole AN-14, located in the SE/4, NE/4, Sec. 16, T.10 N., R.9 W. No outcrop of the Byram Marl was located within Clarke County, although it may be present at the surface but in a sufficiently weathered state to make its detection difficult.

Bucatunna Formation

The name Bucatunna was used by Blanpied et al. (1934) in reference to "a sequence of bentonitic clay, bentonite, and cross-bedded sands. . . ." The area he selected as a type locality is along Bucatunna Creek beginning one-half mile upstream from Dyess Bridge located in Sec. 6, T.8 N., R.5 W., then continuing downstream to approximately 800 feet northeast of the center of Sec. 8, T.8 N., R.5 W., all of which is located north of Denham, Wayne County, Mississippi.

In Clarke County the Bucatunna Formation is comprised of yellowish-gray, reddish-gray, gray to dark-gray to greenish-gray, sandy, sparingly fossiliferous, carbonaceous clay with minor claystone. The above description is from cuttings derived from the test holes as the Bucatunna was not recognized at the surface in Clarke County.

Maximum thickness of the Bucatunna Formation was encountered in Test Hole AN-61, located in the SW/4, SW/4, Sec. 28, T.1 N., R.14 E., where 27 feet was present between the overlying Citronelle and the underlying Glendon.

The clay of the Bucatunna Formation is disconformably overlain by the sand, silt, and clay of the Catahoula Formation in Test Holes AN-14 and 15, located respectively in the SE/4, NE/4, Sec. 16, T.10 N., R.9 W., and SW/4, NW/4, Sec. 13, T.10 N., R.9 W. In Test Hole AN-61 the Bucatunna is unconformably overlain by the sand and gravel of the Citronelle Formation.

The Bucatunna Formation was present in Test Holes AN-14, 15, and 61.

MIOCENE SERIES

CATAHOULA FORMATION

Catahoula as a geologic term was introduced to the literature by Veatch (1905) at which time he stated, "Name proposed from typical development of formation in Catahoula Parish, Louisiana, and used for the lower or typical Grand Gulf of Hilgard as exposed at Grand Gulf, Mississippi. It includes the sandstone bearing clays between the Vicksburg and Fleming Oligocene."

May (1974, p. 112) drilled a test hole in Wayne County which encountered 380 feet of Catahoula deposits without reaching the underlying formation. Thickness is considered by May (1974, p. 113) to be approximately 600 feet in the southwestern part of Wayne County.

DeVries (1963, p. 44) stated, "The Catahoula formation is approximately 500 feet thick at the southwestern corner of Jasper County."

In Clarke County, the Catahoula occurs in a limited area of the southwestern part of the county and is a fine- to medium-grained, clayey, silty sand with minor amounts of pebble-sized gravel. Color is generally one of light-yellowish-gray to gray, with yellowish-brown, yellow and orange-pink also being present. Thickness reaches a maximum of approximately only 84 feet.

An unconformity separates the Catahoula Formation from the overlying Citronelle Formation.

The Catahoula Formation was encountered in only Test Holes AN-14 and 15.

PLEISTOCENE SERIES

CITRONELLE FORMATION

The term Citronelle as a formation name was introduced into the geologic literature by Matson (1916) at which time he stated, "The name Citronelle Formation is applied to sediments of Pliocene age, chiefly nonmarine, that occur near the seaward margin of the Gulf Coastal Plain, extending a short distance east of the western boundary of Florida westward to Texas. . . . Citronelle, a

town on the Mobile and Ohio Railroad, in the northern part of Mobile County, Ala., was chosen as the type locality because of the excellent exposures of the formation in its vicinity, especially to the north along the railroad for a distance of 3 or 4 miles. The best collection of fossils was obtained from a clay bed a few miles south of the type locality, near a station called Lamberts, where a flora sufficiently well preserved to permit correlation of the beds with the Pliocene was found."

Berry (1916, p. 195), in assigning a Pliocene age to the Citronelle Formation, states, "My conclusion is, then, that the flora found in the Citronelle formation belongs in the later half of the Pliocene epoch and is directly ancestral to the Pleistocene and Recent floras of the same region."

Doering (1935), in reference to sand and gravelly sand occurring in southeastern Texas and southern Louisiana, states, "The name 'Willis' is a new name proposed by the writer in this paper for the formation of sand and gravelly sand referred to by Plummer as 'unnamed Pliocene sand' and 'Upper Citronelle sands'." Doering supported the Pliocene age for the Citronelle.

In November 1936 Roy (1939) visited the type locality of the Citronelle Formation. At this time, and during subsequent visits, he concluded that the clay from which Berry (1916, p. 193-208) had derived his fossil plant remains was not part of the Citronelle but instead underlay the sands and gravel of the Citronelle Formation. Thus, Roy (1939) concluded that the Citronelle Formation was Pleistocene in age and not Pliocene.

Brown et al. (1944), in referring to the Graham Ferry Formation, stated, "The stratigraphic relationship to the overlying Citronelle is disconformable, the relationship to the underlying Pascagoula not clear; but the unit includes beds that contain fossils of both Pliocene and Pleistocene age, according to Julia Gardner of the U. S. Geological Survey." Further, he gives the age of the Citronelle as Pleistocene.

Isphording and Lamb (1971) discovered in Mobile County, Alabama, along Chickasabogue Creek, in the NW/4, Sec. 27, T.2 S., R.2 W., a dark gray, carbonaceous, silty clay and clayey sand, approximately 20 feet thick located at the base of the Citronelle. Contained within the clay is an interval near the base which has an abundance of vertebrate remains. During the study Isphording

conducted a micro-faunal, mineralogical, and textural analysis of the clay bed. He concluded that the deposit is Hemphillian (middle Pliocene) in age and was deposited in a lagoon, estuary, or marsh that was receiving sufficient run-off so that the water had low salinity. This supports a humid-tropical or sub-tropical climate for the central Gulf Coast at the time of deposition. Further, he states, "The age of the Citronelle Formation, in the central Gulf Coast, can thus be established as mid-Pliocene through early Pleistocene."

Alt (1974) does not adhere to a humid-tropical or sub-tropical climate for the Citronelle. In referring to the Citronelle Formation he states, "High-level gravels of the southeastern United States are interpreted as remnants of coalescing alluvial fans laid down primarily by braided streams of a pediplain surface during Miocene time under an arid climatic regime."

The writer lists the age of the Citronelle Formation as Pleistocene as it is the age designated on the Geologic Map of Mississippi (Bicker, 1969). No evidence was found by the writer to indicate an age for the Citronelle Formation and no attempt is made to support or deny any specific age for the Citronelle Formation.

In Clarke County the Citronelle is comprised of sand and gravel with lenses of silt and clay located throughout the materials of the formation. Sand, the major component of the formation, is mainly quartz, is fine- to coarse-grained, and is subangular to rounded. The gravel is multicolored and has a composition largely of chert with minor amounts of quartz. Roundness of the gravel ranges from subrounded to well-rounded. Silt and clay is commonly present in the form of discontinuous lenses. Color of the material is variable, being from a yellow to yellow-brown to red-brown to red and in places displaying pinks, purples, light-grays, and grays. Structures and features within the materials consist of ferruginous lenses and nodules, cross-bedding, and clay ball conglomerates.

The outcrop zone of the Citronelle Formation occupies a very limited area in the southwestern part of Clarke County, and is restricted to that area generally above 370 feet in the southwestern corner of the county and above 420 feet along the northern edge of the outcrop zone. Outcrops are present in the form of roadcuts and faces of borrow pits. Shown in Figure 42 is an exposure located in a borrow pit in the SE/4, NW/4, Sec. 31, T.1 N., R.14 E., in which approximately 17 feet of gravelly sand is overlain by 15 feet of clayey

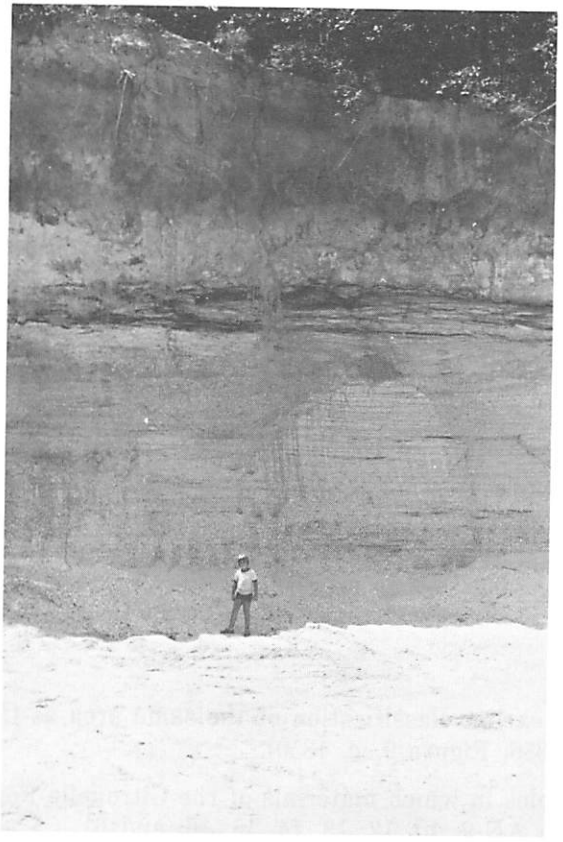

Figure 42.—Exposure of the Citronelle Formation in an active borrow pit with approximately 17 feet of gravel overlain by 15 feet of clayey sand. Location, SE/4, NW/4, Sec. 31, T.1 N., R.14 E.

sand. Figure 43 is a close-up of the gravel shown in Figure 42.

A maximum thickness of 120 feet of sand and gravelly sand of the Citronelle Formation was penetrated prior to encountering the Catahoula Formation in Test Hole AN-12, located in the SW/4, NE/4, Sec. 2, T.10 N., R.9 W.

The area delineated as Citronelle is so classified on the following: 1) the quantity of gravel present, 2) its location at elevations between approximately 370 feet and 500+ feet, thus occupying the highest areas in the southwestern part of the county,

Figure 43.—Close-up photograph of the Citronelle gravel shown in Figure 42.

and 3) the earlier classification of the same area as Citronelle by Doering (1956, Figure 9, p. 1850).

Test holes in which materials of the Citronelle Formation are present are AN-9, 10, 12, 13, 14, 15, 16, and 61.

Terrace Deposits

Large areas of Clarke County are covered by post-Citronelle deposits. These deposits, terraces, are separated from the Citronelle on the basis of elevation, lying at a lower elevation than the Citronelle, and on the basis of composition, containing only minor pebble-sized gravel, usually as isolated pebbles.

Comprising the terrace deposits are sands, generally fine-grained, although all ranges to coarse-grained are known, with minor amounts of pebble-sized gravels also present. Common within the sands are silty, clayey stringers and clay pellets. Color of the deposits vary from light-gray to light-yellowish-gray to yellowish-

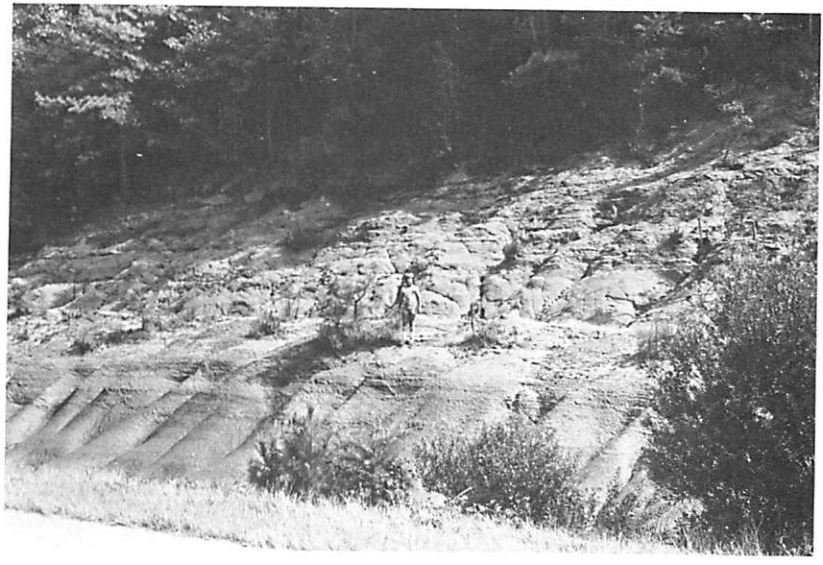

Figure 44.—Terrace sand overlying clays of Cook Mountain Formation. Leslie Gilliland standing at approximate contact. Location, roadcut in the NE/4, Sec. 29, T.4 N., R.14 E.

brown to reddish-brown and grayish-pink to orange-pink (Figure 44).

Terraces, in general, were mapped only in western Clarke County although they may be present in central and eastern areas. In those areas where a sand crops out (Kosciusko, etc.) it would, in instances, be difficult to distinguish "formational" material from terrace sands where the terrace sand directly overlies the "formational" sand.

A maximum thickness of 44 feet of terrace sand was present in Test Hole AN-3, located in the SE/4, NW/4, Sec. 3, T.3 N., R.14 E.

Test Holes AN-3, 19, 20, 39, 45, and 46 penetrated terrace sands.

RECENT SERIES

ALLUVIUM

The majority of the perennial streams of Clarke County have

alluvial deposits, with the extent of the alluvium in large being comparable to the size of the stream. Alluvium was not mapped along the smaller streams of the county due to the minor thickness, generally less than five feet, present.

Material to be found in the alluvium is largely dependent upon the formation(s) through which the stream and near tributary streams are eroding. Essentially the major material present in the alluvium of the streams of Clarke County is quartz sand. Streams flowing through that area with the Basic City in the outcrop zone have claystone fragments present in varying quantities. Also in some areas minor amounts of quartz and chert, pebble-sized gravel is associated with the alluvial deposits. Silty clay, gray to dark-gray, with organic material is present where a sufficiently wide and low floodplain is present for the development of backswamp. Maximum thickness of alluvium penetrated was 34 feet in Test Hole AN-31, located in the NE/4, NW/4, Sec. 24, T.3 N., R.16 E., floodplain of Long Creek.

Alluvium was present in Test Holes AN- 7, 8, 29, 31, 37, 40, 44, 45, 47, 52, and 65.

STRUCTURE

Surface configuration of outcropping strata in Clarke County is influenced by numerous structural features. Clarke County is located in the eastern area of the Mississippi Embayment. The Mississippi Embayment is a part of the Gulf Coast Geosyncline. The position of Clarke County in relation to the Mississippi Salt Basin, Hatchetigbee Anticline, Pickens-Gilbertown Fault System, approximate axis of the Mississippi Embayment, and approximate axis of the Gulf Coast Geosyncline is shown in Figure 45. Further, additional structural features are present in the subsurface of Clarke County but are not shown or discussed.

Hilgard (1860) constructed the first geologic map in which different formations were identified in Clarke County. The first to construct a geologic map involving Clarke County in which faults were delineated were Tourtelot and Morris (1944). Also, Tourtelot and Morris named six faults which are located partly or entirely in Clarke County. The faults named were the Melvin, Gilbertown, Linton, Clarkco, Quitman, and Pachuta Faults.

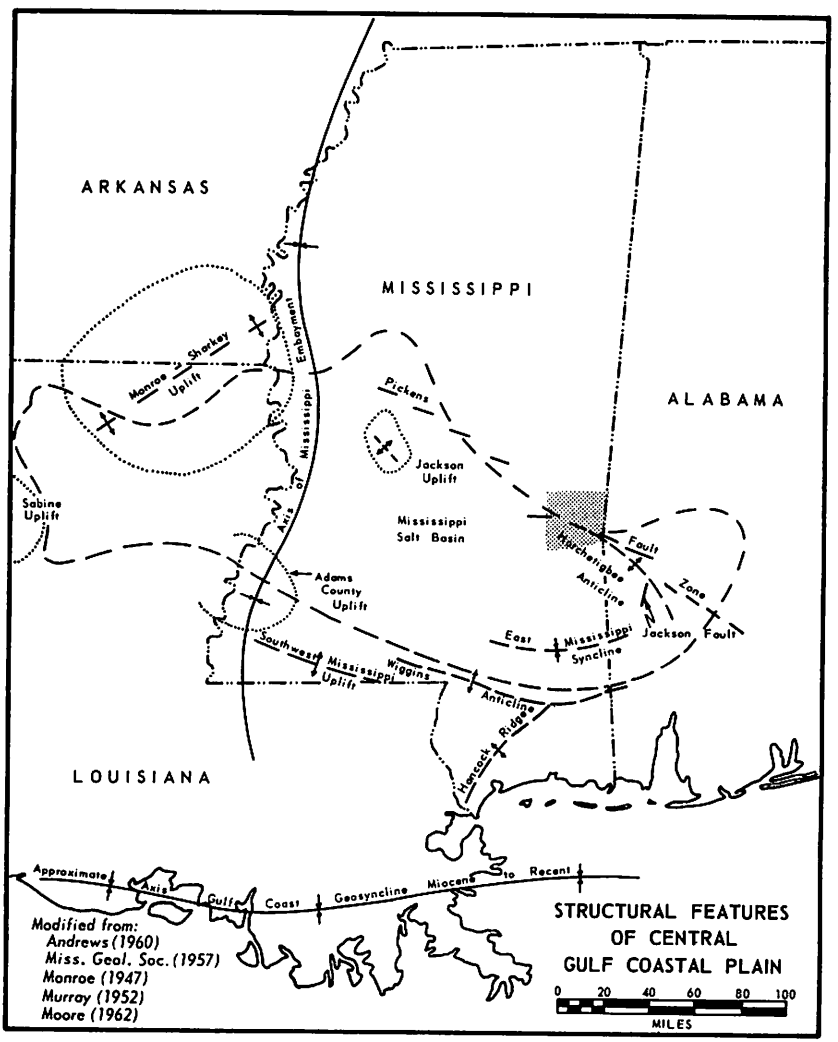

Figure 45.—Structural features of Central Gulf Coastal Plain and location of Clarke County, Mississippi.

In this study four stratigraphic-structural cross-sections were constructed: a dip section, a strike section, and two sections crossing faulted areas (Plate 2).

Regional dip of the surface and near-surface strata is depicted by section A-A′, Plate 2, which extends from the northeastern corner of Clarke County to the southwestern corner of the county. The average dip is approximately 30 feet per mile to the southwest. Dip is not uniform. Northeast of the Clarkco Fault, based on Test Holes AN-28, 27, 26, 25, and 24, dip is on the order of 38 feet per mile to the southwest. From Test Hole AN-23, located in Sec. 8, T.2 N., R.16 E., south of Quitman Fault, southwest to Test Hole AN-20, located in Sec. 17, T.1 N., R.15 E., the average dip is about 20 feet per mile to the southwest, as determined by data from Test Holes AN-23, 22, 21, and 20. Dip in southwestern Clarke County, from Test Hole AN-20, located in Sec. 17, T.1 N., R.15 E., to the southwestern corner of Clarke County is about 33 feet per mile to the southwest based on data derived from Test Holes AN-20, 17, 13, and 14. Test holes used in the construction of the dip section A-A′ are AN-28, 27, 26, 25, 24, Sunoco Energy Development Co. Quitman #1, AN-23, 22, 21, 20, 17, 13, and 14.

Cross-Section B-B′, Plate 2, essentially a strike section, extends from the Mississippi-Alabama State Line in Sec. 21, T.3 N., R.18 W., trending in a west-northwest direction to the northwest corner of Clarke County. A slight flexure in the strata is indicated between Test Hole AN-25, located in Sec. 9, T.3 N., R.17 E., and Test Hole AN-37, located in Sec. 35, T.4 N., R.16 E. Further classification of the structural feature as a dome, anticline, monocline, etc., is not attempted as control is inadequate. Test holes and wells utilized in the construction of section B-B′ are AN-32, East Quitman Water Association #2, AN-25, 36, 37, 41, 38, 42, 44, and 43.

Section C-C′, Plate 2, is a north to south cross-section extending from Test Hole AN-6, located in Sec. 6. T.4 N., R.15 E., south to Test Hole AN-1, located in Sec. 3, T.10 N., R.7 W. In addition to and located between the Clarkco and Quitman Faults are two unnamed faults. Displacement along the Clarkco Fault is approximately 150 feet, with the down-thrown block being to the south. Displacement along the north unnamed fault is about 50 feet, with the down-thrown block being to the north. The unnamed fault to the south has a displacement on the order of 95 feet and the downthrown block is to the north. Displacement along the Quitman Fault is only on the order of approximately 55 feet and the down-thrown block is to the north.

Cross-section D-D′, Plate 2, was constructed generally in a north to south direction for the southeastern part of Clarke County using date derived from the following test holes and wells: AN-35, Theadville Water Assoc. T. H. #1, AN-49, Sohio Petroleum Co. Clarke #77B, AN-52, and Sohio Petroleum Co. Clarke #90-A. Three faults are present as indicated on cross-section D-D′. To the south is the Gilbertown Fault with a displacement of approximately 70 feet and the down-thrown block located to the north. Two unnamed faults exist north of the Gilbertown Fault. The unnamed fault to the south has a displacement of about 50 feet, with the down-thrown block to the north. The unnamed fault to the north has the down-thrown block located to the south and a displacement of about 140 feet.

In addition to the faults discussed above and located along the four cross-sections are two additional major named faults of Clarke County, the Linton and Pachuta Faults, shown on Plate 1, Geologic map of Clarke County. The Linton Fault, located in southeastern Clarke County follows, roughly, the valley of Bucatunna Creek from the southeastern part of T.2 N., R.17 E., trending in a northwest direction to the eastern extent of the Clarkco Fault where the two faults meet. Displacement along the Linton Fault in Sec. 9, T.2 N., R.17 E., is approximately 120 feet and the down-thrown block is located to the southwest. Located near the center of T.2 N., R.14 E., trending in an east-west direction, and extending from Clarke into Jasper County is the Pachuta Fault. Displacement is approximately 70 feet in Sec. 17, T.2 N., R.14 E., and the down-thrown block is to the north.

Although not identified during this study there remains the probability that additional faults are present at the surface in Clarke County.

To date no producing oil or gas wells are located to the north of the faulted area in Clarke County. This lack of producing wells to the north of the fault zone attests to the importance of structural control for oil and gas production in Clarke County.

ECONOMIC GEOLOGY

SAND AND GRAVEL

Extensive deposits of sand suitable for fill in construction, top-

ping, and soil cement in highway construction and other construction is available in Clarke County. Stratigraphic units in which sand borrow pits are common are: Meridian Sand Member, Kosciusko, Cockfield, and Citronelle Formations and terrace deposits. The most extensive and thickest deposits are associated with the Kosciusko Formation.

Deposits of gravelly sand and sandy gravel for road construction and other construction are present in the Citronelle Formation. The Citronelle Formation is limited in area, occurring only in the southwestern corner of the county along a ridge which extends from northcentral Jasper County southeast to northwest Wayne County. This deposit is essentially the only source of gravel for the above area, has probably been mined from the time the area was settled, and will continue to be mined until depleted, which with the limited extent of the deposit should not be in the too distant future.

CLAY

There exists at the surface in Clarke County an abundance of clays. Although there is at present no manufacture of clay products in the county, in the early part of the century brick was manufactured at Quitman by Quitman Brick Manufacturing Company. Bricks were molded in a 15,000 bricks-per-day capacity soft-mud machine operated by horse power (Logan, 1908).

Six samples of clay were forwarded to Tuscaloosa Metallurgy Research Center for evaluation. These samples were from Test Hole AN-59 and from the Basic City Shale member of the Tallahatta Formation. Results were that this material was suitable for the non-plastic component in brick mixes.

Samples from the clays in southern Clarke County were not submitted for testing, as May (1974, p. 131) reported the results of several tests on clays with the distribution of two from the Bucatunna Formation, one from the Forest Hill Formation (Red Bluff Formation of this report), three from the Shubuta Clay member and one from the North Twistwood Creek Clay member of the Yazoo Formation. As Clarke and Wayne are adjoining counties and the tests were on clays from the northern part of Wayne County, the results are herein contained (Tables 4-9).

The majority of the aggregate used in construction in Meridian, Lauderdale County, Mississippi, and the surrounding area, which includes Clarke County, must be transported in from Hattiesburg, 88 miles to the southwest, or from Columbus, 90 miles to the north. Thus, the location of a clay highly suited to the production of light-weight aggregate should be desirable.

The use of a triaxial diagram, developed by Riley (Parks et al., 1964, p. 45), defines a clay's ability to bloat based on its chemical

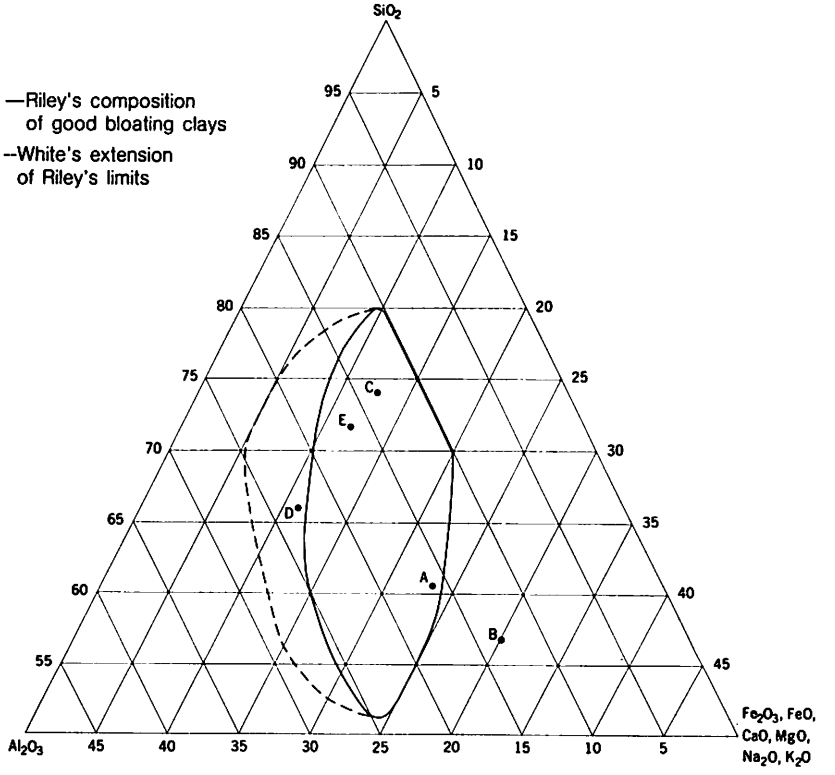

Figure 46.—Riley's diagram showing chemical analysis of five clay samples.

composition. Positioned at the corners of Riley's diagram are silica (SiO_2), alumina (Al_2O_3), and total fluxing constituents (CaO, MgO, Fe_2O_3, Na_2O, FeO, K_2O). The minor constituents and volatile materials associated with the clays are excluded from consideration and the analysis recalculated to 100 percent. Chemical analysis for the materials from Test Holes AM-7, 8, 9, 11, 24 and 46 in Wayne County are given in Table 5 and the recalculated results are plotted on a triaxial diagram in Figure 46 (AM-7 (30'-60') and 8 were not within the limits of the diagram). The clays from Test Holes AM-7 (4'-28'), 11, 24 and 46 plot within the area of bloating on the triaxial diagram; thus, these samples should be considered a possible source of raw material in the production of lightweight aggregate.

The clay from Test Hole AM-11, when analyzed chemically, was found to compare with clays from the Bucatunna Formation in Smith County. These clays in Smith County have been mined and processed as an additive for poultry and livestock feed for a number of years.

Clays from Test Holes AM-7 and AM-24 are possibly a source of clay to be used in drilling mud.

As one is readily aware there exists an abundant supply of clay in Clarke and Wayne Counties for the manufacture of the above discussed clay associated products.

Table 4—PARTICLE-SIZE ANALYSIS FOR SAND, SILT, AND CLAY CONTENTS

Core Number	Location	% Sand 0.05mm	% Silt 0.002-0.05mm	% Clay 0.002mm
AM-7 (4'- 28')	SE/4, SW/4, SW/4, Sec. 10, T.10 N., R.7 W., Wayne County	3.2	23.8	73.0
AM-7 (30'- 60')	SE/4, SW/4, SW/4, Sec. 10, T.10 N., R.7 W., Wayne County	2.6	30.2	67.2
AM-8 (6'- 26')	NE/4, NW/4, NE/4, Sec. 32, T.10 N., R.5 W., Wayne County	4.7	51.4	43.9
AM-9 (4'- 28')	NW/4, NE/4, NE/4, Sec. 6, T.10 N., R.5 W., Wayne County	2.4	49.5	48.1
AM-11 (20'- 24')	NW/4, SW/4, SW/4, Sec. 24, T.10 N., R.9 W., Wayne County	1.8	34.6	63.6
AM-24 (12'- 26')	SW/4, NE/4, NW/4, Sec. 24, T.9 N., R.6 W., Wayne County	5.2	27.8	67.0
AM-46 (42'-104')	SE/4, SE/4, SE/4, Sec. 24, T.10 N., R.7 W., Wayne County	4.8	43.0	52.2

Table 5—CHEMICAL ANALYSIS OF CLAYS, WAYNE COUNTY, MISSISSIPPI
MISSISSIPPI STATE UNIVERSITY LABORATORY
ANALYSIS NUMBERS 463, 200-463, 216

Test Hole	Geologic Unit	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	CaO	Na_2O	K_2O	P_2O_5	Ignition MgO	Ignition SO_3	Ignition Loss	Total
AM-7 (4'- 28')	Yazoo (Shubuta)	46.18	12.53	7.29	0.88	7.70	0.11	1.76	0.58	0.81	3.57	18.90	100.31
AM-7 (30'- 60')	Yazoo (Shubuta)	33.86	11.58	4.18	0.32	21.29	0.24	1.45	0.42	1.03	3.10	25.79	103.66*
AM-8 (6'- 26')	Yazoo (Shubuta)	28.36	10.25	4.82	0.30	29.38	0.05	1.17	0.53	0.78	2.66	28.19	106.49*
AM-9 (4'- 28')	Yazoo (N. Twistwood Cr.)	41.66	9.50	5.00	0.39	14.34	0.06	1.32	0.44	1.56	2.68	22.57	99.52
AM-11 (20'- 24')	Bucatunna	58.36	11.20	5.29	0.65	1.82	0.10	1.23	0.45	0.93	5.37	15.49	100.92
AM-24 (12'- 26')	Bucatunna	57.12	19.75	4.74	0.58	0.14	0.04	1.76	0.41	2.98	1.82	9.02	98.42
AM-46 (42'-104')	Forest Hill (Red Bluff)	61.84	14.05	4.85	0.66	2.11	0.25	2.28	0.45	0.93	4.20	11.61	103.23*

*These totals were higher than might be expected. However, rechecks of major components did not reveal any discrepancies.

Table 6—pH AND CALCIUM CARBONATE EQUIVALENT OF CLAYS

Sample number	pH 1:2.5 H_2O	% Lime $CaCO_3$ Equivalent
AM-7 (4'- 28')	7.6	10.09
AM-7 (30'- 60')	7.7	32.51
AM-8 (6'- 26')	7.8	40.29
AM-9 (4'- 28')	7.8	18.41
AM-11 (20'- 24')	3.6	0.00
AM-24 (12'- 26')	4.6	0.00
AM-46 (42'-104')	8.2	2.78

Table 7—SUMMARY OF THE PHYSICAL AND MECHANICAL PROPERTIES MEASUREMENTS

Core Number	Depth	Working Ability	% Water of Plasticity	Drying or Firing (°F)	% Shrinkage	% Porosity	% Water Absorbtion	Modulus of Rupture (psi)	Color
AM-7	4'-28'	Fair	35.2	198	6.6	—	—	1250	Olive
				1800					
				1900		Gaseous material present			
				2000					
AM-7	30'- 60'	Excellent	35.0	198	6.6	—	—	640	Black
				1800					
				1900		Bloating occurred			
				2000					
AM-8	6'- 26'	Excellent	36.6	198	5.0	—	—	675	Tan
				1800					
				1900		Bloating occurred			
				2000					
AM-9	4'- 28'	Excellent	56.0	198	11.3	—	—	739	Olive
				1800					
				1900		Bloating occurred			
				2000					

Table 7—SUMMARY OF THE PHYSICAL AND MECHANICAL PROPERTIES MEASUREMENTS

Core Number	Depth	Working Ability	% Water of Plasticity	Drying or Firing (°F)	% Shrinkage	% Porosity	%Water Absorbtion	Modulus of Rupture (psi)	Color
AM-11	20'- 24'	Good	35.8	198	3.3	—	½	—	Black
				1800					
				1900		Bloating occurred			
				2000					
AM-24	12'- 26'	Excellent	53.2	198	8.0	—	—	—	Brown
				1800					
				1900		Gaseous material present			
				2000					
AM-46	42'- 104'	Excellent	34.4	198	4.0	—	—	283	Black
				1800					
				1900		Bloating occurred			
				2000					

Table 8—PRELIMINARY BLOATING TESTS OF CLAYS, WAYNE COUNTY, MISSISSIPPI

BUREAU OF MINES—TUSCALOOSA METALLURGY LABORATORY

Core Number	Depth	Lab Number	Temperature of	Percent Absorbtion	Particle Site	Retention Time	Bulk gm/cc	Density lb/ft_3	Remarks
AM-7	4'- 28'	M-2-1	2100	21.2	3/4" pellets	15 min.	1.18	73.5	Minor pore formation. Heavy.
AM-8	6'- 26'	M-2-2	2100	22.1	3/4" pellets	15 min.	1.48	92.4	No pore Formation. Heavy.
AM-9	4'- 28'	M-2-3	2100	3.5	3/4" pellets	15 min.	1.12	69.7	Good pore structure—Heavy.
AM-46	42'-104'	M-2-4	2100	31.5	3/4" pellets	15 min.	0.71	44.6	Fair pore structure—light.

Table 9—CLAY TESTED, THEIR POSSIBLE USES

Core No.	Stratigraphic Unit	Possible Use(s)
AM-7 (4' -28')	Yazoo (Shubuta)	Drilling mud, lightweight aggregate
AM-7 (30'-60')	Yazoo (Shubuta)	Drilling mud
AM-9 (4' -28')	Yazoo (N. T. Creek)	Lightweight aggregate**
AM-11 (20'-24')	Bucatunna	Mineral additives for fee, lightweight aggregate.
AM-24 (12'-26')	Bucatunna	Drilling mud, lightweight aggregate
AM-46 (42'-104')	Forest Hill*	Lightweight aggregate

*Red Bluff of this report.
**Would require blending with other clays.

LIMESTONE AND MARL

Limestones and marls of the Marianna and Glendon Formations, Vicksburg Group, crop out at the surface in southwestern Clarke County. Although not mined in Clarke County, the limestones and marls of the Marianna and Glendon Formations are mined for use as agricultural limestone and for the production of cement. Present mining operations are located near Waynesboro, Wayne County, Mississippi; Raleigh, Smith County, Mississippi; Brandon, Rankin County, Mississippi, and St. Stephens, Washington County, Alabama.

IRON

The earliest mining of iron ore in Mississippi was near Enterprise, Clarke County, Mississippi. A carload of the ore was shipped by rail to the smelter in Birmingham, Alabama, in 1887 (Lowe, 1913). This ore was formed by the process of weathering and concentration of the sandy glauconitic marl of the Winona Formation. The unweathered material is a light-gray to light-green to dark-green, sandy, glauconitic to abundantly glauconitic marl which upon weathering develops a reddish-yellow to reddish-brown to dark-red color. Although these deposits are common in northwest-

ern Clarke County, they are thin, and the ore is of a low grade.

Ferruginous nodules, chiefly siderite, are present in the lower part of the Red Bluff Formation. Maximum thickness of the nodules, located in Sec. 1, T.10 N., R.7 W., is approximately 6 inches. Detailed drilling in the area is required to determine the quality and quantity of material available.

No iron ore of present commercial quality exists in Clarke County.

SULFUR

Sulfur in a quantity of approximately 35 tons per day is produced by the Shell Oil Company, Goodwater Plant located in Sec. 5, T.10 N., R.8 W. Production is from the Smackover Formation. Fields which supply the plant are Lake Utopia, Stafford Springs, Goodwater, Prairie Branch, West Nancy and State Line (Williamson).

OIL AND GAS

The earliest known well drilled in the search for oil and gas in Clarke County was in 1903 and was located one-quarter mile east of the Mobile and Ohio Railroad Station at Enterprise. The last recorded depth for this well is 1842 feet 4 inches, but drilling continued to an undisclosed depth. A total of nineteen wells, in the search for oil and gas, were drilled prior to the discovery of Langsdale Field on January 18, 1945. Quitman Field was discovered on October 21, 1945. Production for both the Langsdale and Quitman Fields was originally from the Eutaw Formation. Production from the Smackover Formation began on September 23, 1966, and from the Cotton Valley Formation on October 12, 1966.

Economically, the most important mineral industry in Clarke County at present is the oil and gas industry. Annual production for 1976 was 9,016,726 barrels of oil and 3,520,865 MCF of gas (Mississippi State Oil and Gas Board). Clarke County ranked first in production of oil and ranked seventh in the production of gas for the eighty-two counties of the state. Cumulative production totals for the individual fields to January 1, 1977, are given in Table 10. Listed in Table 11 are the fields, with location, type of structure, range of producing depths, producing formation(s), and discovery date.

The economic development of Clarke County has been greatly enhanced by the oil and gas industry and related industries. This is expected to continue in the future.

Table 10—OIL AND GAS FIELDS OF CLARKE COUNTY

Field	Cumulative Production to 1-1-77 Oil-Bbls.	Gas-MCF
Barnett	520,660	148,061
Carmichael	407,886	1,521
Davis	9,795,624	104,061
Fluffer Creek	12,304	3,602
Francis Creek	2,237,197	15,891
Garland Creek	49,411	—
Goodwater	4,042,072	6,198,660
Hale	516,973	155,906
Harmony	1,726,273	637,578
South Harmony	4,797	—
Junction City	3,658,746	213,269
Langsdale	4,931,732	127,123
Nancy	4,186,606	2,467,524
East Nancy	7,918,406	3,149,384
North Nancy	20,767	1,020
West Nancy	9,477,552	6,841,802
Pachuta Creek	30,946,125	16,590,771
Prairie Branch	5,380,454	2,816,054
Quitman	15,250,102	3,808,636
Shubuta	360,167	356,948
North Shubuta	485,493	795,636
Stagecoach Road	1,987	5,800
TOTALS	101,931,334	44,439,247

Source: Mississippi State Oil and Gas Board

Table 11—OIL FIELDS OF CLARKE COUNTY AND PERTINENT DATA

Barnett Field

Location: Sec. 32, T.2 N., R.14 E.
Type of structure: Anticline
Range of producing depths: 13,198-13,360
Producing formation(s): Smackover, Buckner
Discovery date: 3-8-74

Carmichael Field

Location: Secs. 5, 6, 8, and 9, T.1 N., R.17 E.
Type of structure: Lobate monocline (stratigraphic trap)
Range of producing depths: 3,630-3,800
Producing formation(s): Eutaw
Discovery date: 4-2-60

Davis Field
Location: Sec. 36, T.3 N., R.15 E., and Sec. 31, T.3 N., R.16 E.
Type of structure: Anticline
Range of producing depths: 5,592-8,246
Producing formation(s): Tuscaloosa, Washita-Fredericksburg, Paluxy
Discovery date: 7-11-69

Fluffer Creek Field
Location: Sec. 25, T.1 N., R.14 E.
Type of structure: ?
Range of producing depths: 15,421-15,429
Producing formation(s): Smackover
Discovery date: 11-2-76

Francis Creek Field
Location: Sec. 3, T.2 N., R.16 E.
Type of structure: Anticline
Range of producing depths: 5,291-6,622
Producing formation(s): Tuscaloosa, Washita-Fredericksburg, Paluxy
Discovery date: 9-15-70

Garland Creek Field
Location: Sec. 3, T.10 N., R.7 W.
Type of structure: Faulted anticline
Range of producing depths: 13,615-13,645
Producing formation(s): Smackover
Discovery date: 9-7-71

Goodwater Field
Location: Sec. 4 and 5, T.10 N., R.8 W.
Type of structure: Anticline
Range of producing depths: 13,615-13,645
Producing formation(s): Smackover
Discovery date: 9-7-71

Hale Field
Location: Sec. 4, T.1 N., R.15 E.
Type of structure: Anticline
Range of producing depths: 13,166-13,252
Producing formation(s): Smackover
Discovery date: 2-7-73

Harmony Field
Location: Sec. 20, T.2 N., R.15 E.
Type of structure: Anticline-pinch out
Range of producing depths: 12,157-12,234
Producing formation(s): Smackover
Discovery date: 3-8-68

South Harmony Field
Location: Sec. 32, T.2 N., R.15 E.
Type of structure: ?

Range of producing depths: 12,976-12,986
Producing formation(s): Smackover
Discovery date: 9-25-76

Junction City Field
Location: T.1 and 2 N., R.16 and 17 E.
Type of structure: Fault trap
Range of producing depths: 2,950-3,850
Producing formation(s): Selma, Eutaw
Discovery date: 1-14-58

Langsdale Field
Location: T.1 N., R.17 and 18 E.
Type of structure: Fault trap
Range of producing depths: 3,622-3,780
Producing formation(s): Eutaw
Discovery date: 12-20-44

Nancy Field
Location: Sec. 11 and 14, T.1 N., R.14 E.
Type of structure: Structural closure
Range of producing depths: 13,120-13,212
Producing formation(s): Smackover
Discovery date: 2-5-67

East Nancy Field
Location: Sec. 17, T.1 N., R.15 E.
Type of structure: Anticline
Range of producing depths: 13,500-14,306
Producing formation(s): Norphlet, Smackover
Discovery date: 4-3-68

North Nancy Field
Location: Sec. 3, T.1 N., R.14 E.
Type of structure: Anticline
Range of producing depths: 13,405-13,429
Producing formation(s): Buckner
Discovery date: 7-17-74

West Nancy Field
Location: Sec. 6, T.1 N., R.14 E.
Type of structure: Anticline
Range of producing depths: 13,745-13,920
Producing formation(s): Smackover
Discovery date: 2-6-70

Pachuta Creek Field
Location: Sec. 15, 22, 23, 24, 25, 26, 27, 35, and 36, T.2 N., R.14 E.
Type of structure: Faulted anticline
Range of producing depths: 12,492-13,144
Producing formation(s): Smackover
Discovery date: 3-23-68

Prairie Branch Field
Location: Sec. 15 and 22, T.1 N., R.14 E.
Type of structure: Anticline
Range of producing depths: 13,480-13,569
Producing formation(s): Smackover
Discovery date: 12-23-70

Quitman Field
Location: Sec. 3, 4, 9, and 10, T.2 N., R.16 E.
Type of structure: Faulted anticline
Range of producing depths: 3,624-11,962
Producing formation(s): Eutaw, Mooringsport, Cotton Valley, Smackover
Discovery date: 10-21-45

Shubuta Field
Location: Sec. 7, T.10 N., R.7 W.
Type of structure: Faulted anticline
Range of producing depths: 13,748-13,810
Producing formation(s): Smackover
Discovery date: 7-4-69

North Shubuta Field
Location: Sec. 35, T.1 N., R.15 E.
Type of structure: Faulted structural closure
Range of producing depths: 14,197-14,266
Producing formation(s): Smackover
Discovery date: 6-5-70

Stagecoach Road Field
Location: Sec. 19, T.2 N., R.14 E.
Type of structure: ?
Range of producing depths: 13,148-13,189
Producing formation(s): Smackover
Discovery date: 11-2-76

TEST HOLE AND CORE HOLE RECORDS

During the field work for this report a total of 66 test holes were drilled and/or cored for various reasons, mostly for stratigraphic information. Of the 66 total, 63 of the holes were drilled under the supervision of David R. Williamson (holes 1 through 63). The writer was present only during the drilling of 3 holes (holes 64, 65, and 66). The cuttings, after washing, were stored in the Bureau's Sample Library and are available for inspection by the public.

The prefix AN is used in front of all numbers for test or core holes drilled by the Bureau of Geology in Clarke County in the preparation of this publication. The prefix AN is reserved for

Clarke County and is utilized in the identification, storing, and location of the cuttings.

Location of the holes was by means of topographic maps, 7.5 minute or 15 minute, whichever was available for the particular area under consideration. Pertinent data is given for each hole.

AN-1

Location: SE/4, SE/4, SW/4, Sec. 3, T.10 N., R.7 W.

Elevation: 275 feet (Topographic map) Date: October 26, 1976

Purpose: Drilled 194 feet for stratigraphic information. Electrical log from 0 to 194 feet. Cored type locality of Shubuta Clay from 0 to 91 feet.

Depth	Thickness	Description
		Jackson Group (Yazoo Formation—Shubuta Clay member)
12	12	Clay, yellowish-brown, reddish-brown, mottled, ferruginous, gypsiferous.
38	26	Clay, yellowish-brown to yellowish-gray, fossiliferous.
94	56	Clay, light-green to olive-greenish-gray, fossiliferous.
		Jackson Group (Yazoo Formation—Pachuta Marl member)
110	16	Clay, light-greenish-gray, marly, sandy, glauconitic, fossiliferous.
		Jackson Group (Yazoo Formation—Cocoa Sand member)
135	25	Sand, light-gray, fine-grained, calcareous, fossiliferous.
		Jackson Group (Yazoo Formation—North Twistwood Creek Clay member)
155	20	Clay, light-greenish-gray, silty, fossiliferous.
189	34	Clay, light-green, silty, fossiliferous.
		Jackson Group (Moodys Branch Formation)
194	5	Marl, light-grayish-green, sandy, glauconitic, fossiliferous.

AN-2

Location: NW/4, NW/4, Sec. 17, T.2 N., R.14 E. On the west side of U.S. Highway 11.

Elevation: 275 feet (Topographic map) Date: October 28, 1976

Purpose: Drilled 380 feet for stratigraphic information. Electrical log from 2 to 370 feet. Also, cored to 67.5 feet, type locality of the Pachuta Marl member of the Yazoo Formation.

Depth	Thickness	Description
		Jackson Group (Yazoo Formation—Pachuta Marl member)
12.5	12.5	Clay, yellowish-brown, fossiliferous.
		Jackson Group (Yazoo Formation—North Twistwood Creek Clay member)
30	17.5	Clay, light-bluish-green, fossiliferous.
63	33	Clay, light-grayish-green, fossiliferous.

		Jackson Group (Moodys Branch Formation)
80	17	Marl, light-greenish-gray, clayey, sandy, fossiliferous, glauconitic.
		Claiborne Group (Cockfield Formation)
97	17	Silt, dark-brown, clayey, carbonaceous.
130	33	Sand, light-brown, fine-grained, clay streaks.
160	30	Silt, dark-brown, sandy, clayey, lignitic.
174	14	Sand, brown to dark-brown, clayey, lignitic.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
191	17	Clay, light-grayish-brown, sandy, carbonaceous.
222	31	Clay, greenish-brown, silty, carbonaceous.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
240	18	Marl, light-green, clayey, glauconitic, partially indurated.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
280	40	Marl, light-yellowish-green, sandy, fossiliferous, glauconitic, clay streaks.
300	20	Clay, light-grayish-green, marly, sandy, fossiliferous.
		Claiborne Group (Kosciusko Formation)
310	10	Clay, dark-brown, silty.
328	18	Sand, greenish-gray, fine-grained, clayey, glauconitic, carbonaceous.
350	22	Sand, greenish-gray, fine-grained, clayey, fossiliferous, lignitic.
380	30	Clay, dark-brown to black, lignitic.

AN-3

Location: SE/4, SE/4, NW/4 Sec. 3, T.3 N., R.14 E. South of Enterprise, firetower, 75 yards; west of U.S. Highway 11, 25 yards.

Elevation: 400 feet (Topographic map) Date: November 3, 1976

Purpose: Drilled 340 feet for stratigraphic information. Electrical log from 3 to 296 feet.

Depth	Thickness	Description
		Terrace Deposit
20	20	Sand, reddish-brown, fine-grained.
44	24	Sand, yellowish-orange, fine-grained.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
56	12	Clay, yellowish-orange, silty.
62	6	Clay, grayish-green, silty, carbonaceous.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
75	13	Marl, light-grayish-green, clayey, glauconitic, fossiliferous.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
118	43	Marl, light-grayish-green, sandy, glauconitic, fossiliferous.
120	2	Limestone, light-greenish-gray, fossiliferous, glauconitic.
		Claiborne Group (Kosciusko Formation)
136	16	Sand, light-greenish-gray, fine- to medium-grained, clayey.

178	42	Sand, light-brown, fine- to medium-grained, lignitic, clayey.
190	12	Sand, light-grayish-green, fine-grained, carbonaceous, clayey.
250	60	Sand, light-gray to light-grayish-brown, fine- to medium-grained, lignitic.
286	36	Sand, greenish-gray, fine-grained, clayey, lignitic.
		Claiborne Group (Zilpha Formation)
312	26	Clay, greenish-gray, silty, glauconitic
		Claiborne Group (Winona Formation)
330	18	Sand, grayish-green, very fine-grained, glauconitic, fossiliferous.
340	10	Clay, gray, sandy, fossiliferous.

AN-4

Location: NW/4, NW/4, NW/4, NE/4, Sec. 10, T.3 N., R.14 E. On the east side of U.S. Highway 11, 300 feet south of the overpass.

Elevation: 380 feet (Topographic map) Date: November 4, 1976

Purpose: Cored 36.5 feet at type locality of Gordon Creek Shale member for stratigraphic information. Electrical log from 2 to 35 feet.

Depth	Thickness	Description
		Claiborne Group (Cockfield Formation)
13.75	13.75	Clay, very pale-orange to grayish-orange; silty streaks, reddish- to dark-yellowish-orange; sand, pale-yellowish-orange, fine-grained.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
32	18.25	Clay, greenish-black to dark-greenish-gray, shaly, micaceous; silt laminae, light-gray to greenish-gray.
34.5	2.5	Clay, dark-greenish-gray, silty, laminated, micaceous.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
36	1.5	Clay, dark-greenish-gray, silty, glauconitic, calcareous, fossiliferous.
36.5	0.5	Clay, dark-greenish-gray to grayish-yellow-green, silty, glauconitic, calcareous, fossiliferous, partially indurated.

AN-5

Location: Lauderdale County. NW/4, SW/4, NW/4, NW/4, Sec. 33, T.5 N., R.15 E.

Elevation: 400 feet (Topographic map) Date: November 22, 1976

Purpose: Drilled 170 feet for stratigraphic information. Electrical log from 0 to 168 feet.

Depth	Thickness	Description
		Claiborne Group (Zilpha-Winona Formation(s)
10	10	Sand, reddish-orange, medium- to coarse- grained, ferruginous.
20	10	Sand, reddish-brown, medium-grained, clayey, ferruginous, glauconitic.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
24	4	Clay, brownish-yellow, silty, glauconitic, carbonaceous.
35	11	Claystone, clay, light-greenish-gray, glauconitic.
45	10	Clay, grayish-green, silty.

70	25	Claystone, clay, light-gray to light-greenish-gray, glauconitic.
115	45	Claystone, clay, light-gray.
124	9	Clay, light-greenish-gray, sandy, glauconitic.
		Claiborne Group (Tallahatta Formation—Meridian Sand member)
145	21	Sand, light-gray, medium-grained, clay streaks, gray to black, lignitic.
		Wilcox Group (Hatchetigbee Formation)
170	25	Clay, light-gray to gray, silty, carbonaceous.

AN-6

Location: NW/4, SE/4, NW/4, Sec. 6, T.4 N., R.15 E. Fifty yards west of Old Zion Hill Church.

Elevation: 350 (Topographic map) Date: November 23, 1976

Purpose: Drilled 350 feet for stratigraphic information. Electrical log from 0 to 349 feet.

Depth	Thickness	Description
		Claiborne Group (Kosciusko Formation)
10	10	Sand, reddish-brown, fine-grained, clayey.
20	10	Sand, reddish-brown, medium- to coarse-grained.
		Claiborne Group (Zilpha Formation)
38	18	Silt, grayish-brown, clayey.
46	8	Clay, grayish-green, sandy.
58	12	Clay, dark-gray to grayish-brown.
		Claiborne Group (Winona Formation)
80	22	Sand, green to grayish-green, very-fine-grained, glauconitic, fossiliferous.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
90	10	Clay, light-gray, sandy.
111	21	Clay, claystone, light-green, silty, glauconitic.
140	29	Clay, green to dark-green, claystone streaks.
192	52	Clay, claystone, light-grayish-green to green.
		Claiborne Group (Tallahatta Formation—Meridian Sand member)
214	22	Sand, light-brown, fine-grained, silty.
228	14	Sand, light-brown, fine-grained, clay streaks, lignitic.
		Wilcox Group (Hatchetigbee Formation)
265	37	Clay, dark-gray, silty.
289	24	Silt, greenish-gray, clayey, sandy, carbonaceous.
310	21	Clay, light-green to gray, silty.
325	15	Silt, light-grayish-green, clayey, carbonaceous.
340	15	Silt, light-gray to light-greenish-gray, clayey, lignitic.
350	10	Silt, grayish-brown to gray, sandy, clayey, carbonaceous.

AN-7

Location: Near center S/2, Sec. 8 T.4 N., R.15 E.

Elevation: 255 feet (Topographic map) Date: November 24, 1976

Purpose: Drilled 130 feet for stratigraphic information. Electrical log from 0 to 122 feet.

Depth	Thickness	Description
		Alluvium
10	10	Sand, yellowish-brown, fine-grained, clayey.
15	5	Sand, light-gray, fine-grained, pea gravel, weathered claystone.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
30	15	Clay, claystone, light-greenish-gray.
54	24	Clay, light-greenish-gray, silty, claystone streaks.
60	6	Clay, light-green, silty.
		Claiborne Group (Tallahatta Formation—Meridian Sand member)
69	9	Sand, gray, fine-grained, carbonaceous.
85	16	Sand, light-brown, fine- to medium-grained, silty, lignitic.
101	16	Sand, white to light-gray, medium-to coarse-grained.
		Wilcox Group (Hatchetigbee Formation)
118	17	Silt, dark-gray, clayey, carbonaceous.
130	12	Silt, dark-gray, sandy, lignitic.

AN-8

Location: NW/4, NW/4, NE/4, Sec. 23, T.2 N., R.15 E. Top of hill.

Elevation: 270 feet (Topographic map) Date: December 2, 1976

Purpose: Drilled 310 feet for stratigraphic information. Electrical log from 0 to 309 feet. Type locality of Archusa Marl member.

Depth	Thickness	Description
		Alluvium
10	10	Sand, yellowish-orange, medium- to coarse-grained, pea gravel.
32	22	Silt, yellowish-brown, clayey.
37	5	Clay, yellowish-brown, sandy.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
60	23	Clay, gray to greenish-gray, silty.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
78	18	Clay, greenish-gray, silty, sandy, glauconitic, fossiliferous.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
100	22	Marl, light-green to light-greenish-gray, clayey, glauconitic, fossiliferous.
118	18	Marl, light-grayish-green, clayey, glauconitic, fossiliferous, limestone lenses.
135	17	Marl, light-green, sandy, silty, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
160	25	Clay, grayish-green to dark-green, sandy, glauconitic, fossiliferous.
180	20	Sand, light-brownish-gray to grayish-brown, fine-grained, clay streaks, lignitic.
185	5	Sand, light-brown, medium- to coarse-grained, lignitic.
188	3	Clay, gray to black, silty, lignitic.
219	31	Sand, light-brown to brown, fine-grained, clayey, lignitic.
228	9	Clay and lignite, dark-gray to black.

237	9	Sand, light-brown, medium-grained.
260	23	Sand, light-brown, fine-grained, clayey, lignitic.
280	20	Sand, light-brown, medium- to coarse-grained, lignitic.
		Claiborne Group (Zilpha Formation)
298	18	Clay, brown to greenish-brown.
		Claiborne Group (Winona Formation)
310	12	Clay, light-green to yellowish-green to green, sandy, fossiliferous, glauconitic.

AN-9

Location: SW/4, SE/4, SE/4, Sec. 28, T.1 N., R.14 E.

Elevation: 450 feet (Topographic map) Date: December 7, 1976

Purpose: Drilled 60 feet for stratigraphic information. No electrical log.

Remarks: Abandoned. Hole would not hold fluid.

Depth	Thickness	Description
		Citronelle Formation
10	10	Sand, orangish-brown, coarse-grained, clayey, ferruginous, pea gravel.
20	10	Sand, yellowish-orange, coarse-grained, small gravel.
34	14	Sand, light-yellow, fine- to-coarse-grained, pea gravel.
		Vicksburg Group (Bucatunna Formation)
39	5	Clay, light-gray to red, mottled.
46	7	Clay, light- to dark-gray.
		Vicksburg Group (Byram Formation)
60	14	Limestone, light-yellowish-brown, clayey, fossiliferous.

AN-10

Location: SW/4, SE/4, SW/4, Sec. 28, T.1 N., R.14 E.

Elevation: 450 feet (Topographic map) Date: December 7, 1976

Purpose: Drilled 65 feet for stratigraphic information. No electrical log.

Remarks: Abandoned. Hole would not hold fluid.

Depth	Thickness	Description
		Citronelle Formation
10	10	Sand, reddish-brown to orangish-brown, coarse-grained, clayey, pea gravel, ferruginous.
30	20	Sand, yellowish-orange, fine- to coarse-grained, pea gravel, ferruginous.
		Vicksburg Group (Bucatunna Formation)
40	10	Clay, gray to red, mottled.
49	9	Clay, light- to dark-gray.
		Vicksburg Group (Byram Formation)
65	16	Limestone, light gray to light-yellowish-brown, clayey, fossiliferous.

AN-11

Location: Center S/2, Sec. 28, T.1 N., R.14 E.

Elevation: 375 feet (Topographic map) Date: December 19, 1976

Purpose: Drilled 350 feet for stratigraphic information. Electrical log from 0 to 349 feet.

Depth	Thickness	Description
		Vicksburg Group (Mint Spring Formation)
14	14	Clay, yellowish-gray to red, mottled.
19	5	Limestone, yellow to bluish-gray, fossiliferous.
		Red Bluff Formation
80	61	Clay, gray, sparsely fossiliferous.
90	10	Clay, gray, claystone, sparsely fossiliferous.
100	10	Clay, gray, silty, sparsely fossiliferous, carbonaceous.
110	10	Clay, gray, fossiliferous, carbonaceous.
136	26	Clay, gray, fossiliferous.
		Jackson Group (Yazoo Formation—Shubuta Clay member)
264	128	Clay, light-green to light-greenish-gray, fossiliferous.
		Jackson Group (Yazoo Formation—Pachuta Marl member)
275	11	Marl, light-gray to light-greenish-gray, clayey, glauconitic, fossiliferous.
		Jackson Group (Yazoo Formation—North Twistwood Creek Clay member)
340	65	Clay, light-green to light-greenish-gray, fossiliferous.
		Jackson Group (Moodys Branch Formation)
350	10	Marl, greenish-gray, clayey, glauconitic, fossiliferous.

AN-12

Location: SW/4, NE/4, Sec. 2, T.10 N., R.9 W.

Elevation: 490 feet (Topographic map) Date: December 10, 1976

Purpose: Drilled 120 feet for stratigraphic information. No electrical log.

Remarks: Abandoned. Hole would not hold fluid.

Depth	Thickness	Description
		Citronelle Formation
10	10	Sand, reddish-orange, medium-grained, clayey.
20	10	Sand, reddish-orange, medium-grained, clayey, pea gravel.
30	10	Sand, yellowish-orange, medium- to coarse-grained, clayey, gravelly.
40	10	Sand, light-orange, fine- to medium-grained, pea gravel, ferruginous.
80	40	Sand, light-yellowish-orange to grayish-yellow, fine-grained.
106	26	Sand, grayish-yellow, medium-grained, clay streaks.
120	14	Sand, reddish-orange to grayish-yellow, fine- to coarse-grained, gravelly.

AN-13

Location: Center S/2, SW/4, NE/4, Sec. 1, T.10 N., R.9 W.

Elevation: 435 feet (Topographic map) Date: December 28, 1976

Purpose: Drilled 420 feet for stratigraphic information. Electrical log from 2 feet to 402 feet.

Depth	Thickness	Description
		Citronelle Formation
20	20	Sand, yellowish-orange, medium- to coarse-grained, pea gravel.
30	10	Silt, yellowish-orange, sandy.
50	20	Sand, light-yellowish-orange, fine-grained, silty.
60	10	Sand, light-yellowish-orange, fine- to medium-grained, pea gravel.
68	8	Sand, light-yellow, fine- to coarse-grained, pea gravel, ferruginous.
		Vicksburg Group (Marianna Formation)
69	1	Clay, yellow, bentonitic.
80	11	Clay, greenish-yellow, marly, fossiliferous.
		Vicksburg Group (Mint Spring Formation)
85	5	Marl, very light-yellow, clayey, fossiliferous.
94	9	Marl, yellowish-green, sandy, glauconitic, fossiliferous.
100	6	Marl, light-bluish-gray, sandy, fossiliferous.
		Red Bluff Formation
130	30	Clay, dark-gray, silty, carbonaceous.
140	10	Clay, dark-gray, fossiliferous, carbonaceous.
160	20	Clay, gray, carbonaceous.
180	20	Clay, greenish-gray, fossiliferous, carbonaceous.
210	30	Clay, dark-greenish-gray, fossiliferous.
		Jackson Group (Yazoo Formation—Shubuta Clay member)
326	116	Clay, light-green, fossiliferous.
		Jackson Group (Yazoo Formation—Pachuta Marl member)
340	14	Clay, light-grayish-green, marly, glauconitic, fossiliferous.
		Jackson Group (Yazoo Formation-North Twistwood Creek Clay member)
396	56	Clay, light-grayish-green, fossiliferous.
		Jackson Group (Moodys Branch Formation)
410	14	Clay, green, silty, sandy, glauconitic, fossiliferous.
415	5	Silt, brownish-gray, glauconitic, fossiliferous.
		Claiborne Group (Cockfield Formation)
420	5	Clay, brown, silty, carbonaceous.

AN-14

Location: Center NW/4, SE/4, NE/4, Sec. 16, T.10 N., R.9 W.

Elevation: 425 feet (Topographic map) Date: December 29, 1976

Purpose: Drilled 300 feet for stratigraphic information. Electrical log from 2 feet to 299 feet.

Depth	Thickness	Description
		Citronelle Formation
44	44	Electrical log indicates sand or gravel. Cuttings questionable as to interval represented.

		Catahoula Formation
70	26	Electrical log indicates silts or silty sand. Cuttings questionable as to interval represented.
118	48	Electrical log indicates sand. Cuttings questionable as to interval represented.
		Vicksburg Group (Bucatunna Formation)
139	21	Clay, dark-gray, carbonaceous.
		Vicksburg Group (Byram Formation)
153	14	Marl, light-gray to greenish-gray, clayey, glauconitic, fossiliferous.
		Vicksburg Group (Glendon Formation)
160	7	Limestone, gray, clay streaks, fossiliferous.
170	10	Limestone, light-gray, fossiliferous.
		Vicksburg Group (Marianna Formation)
194	24	Clay, bluish-gray, marly, fossiliferous.
		Vicksburg Group (Mint Spring Formation)
210	16	Clay, bluish-gray, sandy, glauconitic, fossiliferous.
		Red Bluff Formation
234	24	Clay, brownish-gray, glauconitic, carbonaceous.
243	9	Clay, greenish-gray, fossiliferous.
254	11	Clay, gray, fossiliferous, carbonaceous.
264	10	Clay, light-gray, sandy, fossiliferous.
290	26	Clay, greenish-gray, silty, fossiliferous.
300	10	Clay, gray, silty, fossiliferous.

AN-15

Location: NW/4, NE/4, SW/4, NW/4, Sec. 13, T.10 N., R.9 W.

Elevation: 485 feet (Topographic map) Date: December 30, 1976

Purpose: Drilled 300 feet for stratigraphic information. Electrical log from 2 feet to 299 feet.

Depth	Thickness	Description
		Citronelle Formation
20	20	Clay, reddish-brown, sandy.
30	10	Sand, yellowish-orange, medium-grained, ferruginous.
50	20	Sand, yellowish-orange, fine- to coarse-grained, pea gravel, ferruginous.
60	10	Sand, very light-yellow, fine- to coarse-grained, pea gravel.
80	20	Sand, yellowish-orange, fine- to medium grained, clayey.
		Catahoula Formation
86	6	Clay, light-gray to reddish-purple, sand streaks.
110	24	Sand, light-gray, fine-grained, clayey.
130	20	Sand, light-gray to yellowish-gray, fine-grained, clay streaks.
134	4	Silt, yellowish-gray to reddish-purple, sandy.
140	6	Sand, yellowish-gray, fine- to coarse-grained, clay streaks.
160	20	Sand, light-yellowish-gray, fine-grained, silt lenses, pinkish-orange.
171	11	Sand, grayish-yellow, fine- to coarse-grained, silty.
		Vicksburg Group (Bucatunna Formation)

180	9	Clay, greenish-gray to bluish-gray.
		Vicksburg Group (Glendon Formation)
198	18	Limestone, bluish-gray to greenish-gray, fossiliferous.
		Vicksburg Group (Marianna Formation)
217	19	Marl, light-greenish-gray to yellowish-gray, clayey, fossiliferous.
		Vicksburg Group (Mint Spring Formation)
237	20	Marl, light-greenish-gray, clayey, glauconitic, fossiliferous.
		Red Bluff Formation
250	13	Clay, dark-gray, fossiliferous, carbonaceous.
270	20	Clay, dark-gray, sandy, fossiliferous.
300	30	Clay, dark-gray, fossiliferous, carbonaceous.

AN-16

Location: Center E/2, SW/4, SW/4, NE/4, Sec. 30, T.1 N., R.14 E.

Elevation: 415 feet (Topographic map) Date: January 25, 1977

Purpose: Drilled 250 feet for stratigraphic information. Electrical log from 0 to 250 feet.

Depth	Thickness	Description
		Citronelle Formation
5	5	Sand, yellow to reddish-orange, fine- to coarse-grained, clayey, gravelly, ferruginous.
20	15	Sand, grayish-brown, gravellly, ferruginous, clay, yellow to pinkish-red.
32	12	Sand, yellowish-gray, fine-grained, clayey, pea gravel, ferruginous.
		Vicksburg Group (Glendon Formation)
40	8	Limestone, white to yellowish-brown, clayey, fossiliferous.
		Vicksburg Group (Marianna Formation)
54	14	Marl, light-greenish-gray to bluish-gray, clayey, fossiliferous.
		Vicksburg Group (Mint Spring Formation)
65	11	Marl, bluish-gray, clayey, glauconitic, fossiliferous.
		Red Bluff Formation
100	35	Clay, dark-gray, silty, fossiliferous, carbonaceous.
120	20	Clay, gray, silty.
140	20	Clay, dark-green to greenish-gray, fossiliferous, carbonaceous.
160	20	Clay, gray, silty, fossiliferous, carbonaceous.
189	29	Clay, dark greenish-gray to dark-gray, fossiliferous.
		Jackson Group (Yazoo Formation—Shubuta Clay member)
250	61	Clay, light-green to light-greenish-gray, fossiliferous.

AN-17

Location: Center east line SE/4, NE/4, SE/4, Sec. 35, T.1 N., R.14 E.

Elevation: 360 feet (Topographic map) Date: January 26, 1977

Purpose: Drilled 360 feet for stratigraphic information. Electrical log from 0 to 359 feet.

Depth	Thickness	Description
		Red Bluff Formation
10	10	Clay, reddish-brown, yellowish-gray, light-gray, silty.
20	10	Clay, light-gray, yellowish-gray, silty, limonite staining.
27	7	Clay, gray to yellowish-gray, silty, ferruginous.
80	53	Clay, gray, silty, fossiliferous, carbonaceous.
113	33	Clay, gray, glauconitic, fossiliferous.
		Jackson Group (Yazoo Formation—Shubuta Clay member)
229	116	Clay, light-greenish-gray, fossiliferous.
		Jackson Group (Yazoo Formation—Pachuta Marl member)
239	10	Marl, light-gray to greenish-gray, clayey, glauconitic, fossiliferous.
		Jackson Group (Yazoo Formation—North Twistwood Creek Clay member)
250	11	Clay, light-greenish-gray, silty, glauconitic, fossiliferous.
300	50	Clay, light-grayish-green, fossiliferous.
		Jackson Group (Moodys Branch Formation)
312	12	Marl, greenish-gray, clayey, sandy, glauconitic, fossiliferous.
		Claiborne Group (Cockfield Formation)
328	16	Silt, gray to dark-gray, carbonaceous.
349	21	Sand, gray, fine-grained, carbonaceous.
360	11	Clay, light-gray, to gray, silty, carbonaceous.

AN-18

Location: Near Center NE/4, SE/4, NE/4, Sec. 34, T.1 N., R.15 E.

Elevation: 205 feet (Topographic map) Date: January 26, 1977

Purpose: Drilled 120 feet for stratigraphic information. Electrical log from 0 to 119 feet.

Depth	Thickness	Description
		Alluvium
10	10	Clay, gray to yellowish-brown, sandy.
17	7	Sand, gray, fine- to coarse-grained, pea gravel.
		Jackson Group (Yazoo Formation—Cocoa Sand member)
21	4	Sand, light-gray to light-greenish-gray, fine-grained, fossiliferous, indurated streak.
		Jackson Group (Yazoo Formation—North Twistwood Creek Clay member)
50	29	Clay, light-greenish-gray, silty, fossiliferous.
91	41	Clay, light-grayish-green, fossiliferous.
		Jackson Group (Moodys Branch Formation)
110	19	Marl, green to light-gray, clayey, sandy, glauconitic, fossiliferous.
		Claiborne Group (Cockfield Formation)
120	10	Clay, brownish-gray to dark-gray, sandy, carbonaceous.

AN-19

Location: Near center N/2, NE/4, SE/4, Sec. 22, T.1 N., R.15 E. In middle of road to abandoned oil site, on hilltop.

Elevation: 330 feet (Topographic map) Date: January 27, 1977

Purpose: Drilled 340 feet for stratigraphic information. Electrical log from 9 to 339 feet.

Depth	Thickness	Description
		Terrace Deposit
10	10	Clay, reddish-brown, sandy.
25	15	Silt, light-gray to yellowish-orange, clayey.
34	9	Silt, light-gray to orangish-red, clayey, sandy, minor pea gravel.
		Jackson Group (Yazoo Formation—Shubuta Clay member)
40	6	Clay, light-grayish-green, fossiliferous.
70	30	Clay, light-green to green, fossiliferous, glauconitic.
		Jackson Group (Yazoo Formation—Pachuta Marl member)
83	13	Marl, light-gray to bluish-gray, sandy, fossiliferous.
		Jackson Group (Yazoo Formation—Cocoa Sand member)
89	6	Sand, bluish-gray to light-grayish-green, fine-grained, clayey, fossiliferous.
		Jackson Group (Yazoo Formation—North Twistwood Creek Clay member)
95	6	Clay, light-bluish-gray, silty, fossiliferous.
156	61	Clay, light-green to green, fossiliferous.
159	3	Clay, light-greenish-gray, fossiliferous.
		Jackson Group (Moodys Branch Formation)
167	8	Marl, greenish-gray, sandy, fossiliferous, glauconitic.
172	5	Clay, grayish-brown to brown, sandy, fossiliferous.
		Claiborne Group (Cockfield Formation)
197	25	Sand, brown, very fine-grained, clayey, lignitic.
215	18	Sand, brown to greenish-brown, fine-grained, clayey, lignitic.
236	21	Sand, brown to dark-brown, fine-grained, lignitic.
254	18	Sand, dark-brown, very fine-grained, clayey, lignitic.
284	30	Silt, brown to grayish-brown, clayey.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
302	18	Clay, greenish-gray, sandy, glauconitic.
310	8	Clay, greenish-gray, silty.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
330	20	Marl, grayish-green, sandy, clayey, glauconitic, fossiliferous.

AN-20

Location: SW/4, SW/4, NW/4, SW/4, NW/4, Sec. 17, T.1 N., R.15 E. On southwest side of gravel road.

Elevation: 295 feet (Topographic map) Date: February 1, 1977

Purpose: Drilled 210 feet for stratigraphic information. Electrical log from 0 to 209 feet.

Depth	Thickness	Description
		Terrace Deposit
10	10	Sand, yellowish-orange, clayey.
		Jackson Group (Yazoo Formation—North Twistwood Creek Clay member)
20	10	Clay, yellowish-gray to bluish-gray.
64	44	Clay, light-grayish-green, fossiliferous.
		Jackson Group (Moodys Branch Formation)
76	12	Marl, greenish-gray, sandy, clayey, fossiliferous, glauconitic.
		Claiborne Group (Cockfield Formation)
90	14	Clay, dark-brown, sandy, lignitic.
134	44	Sand, brown, fine-grained, clayey, lignitic.
140	6	Clay, grayish-brown, sandy, lignitic.
145	5	Sand, grayish-brown, fine-grained.
180	35	Clay, yellowish-grayish-brown, sand streaks, carbonaceous.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
196	16	Clay, dark-grayish-brown, silty.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
210	14	Marl, green to grayish-green, sandy, clayey, fossiliferous, glauconitic.

AN-21

Location: SE corner, NE/4, SW/4, NW/4, SW/4, Sec. 3, T.1 N., R.15 E. On the southwest side of the road.

Elevation: 290 feet (Topographic map) Date: February 2, 1977

Purpose: Drilled 280 feet for stratigraphic information. Electrical log from 0 to 279 feet.

Depth	Thickness	Description
		Jackson Group (Moodys Branch Formation)
14	14	Clay, grayish-yellow, marly, fossiliferous, glauconitic.
		Claiborne Group (Cockfield Formation)
25	11	Clay, yellowish-gray, sandy.
38	13	Clay, dark-brown to black, sandy, lignitic.
48	10	Clay, brown, silty, shaly.
60	12	Sand, greenish-gray, fine-grained, clayey.
84	24	Sand, greenish-gray, fine-grained, clay streaks, lignitic.
105	21	Sand, greenish-gray, fine-grained, clayey.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
142	37	Clay, greenish-gray to gray, silty.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
150	8	Marl, light-yellowish-gray to light-greenish-gray, clayey, glauconitic, fossiliferous.
160	10	Marl, greenish-gray, clayey, glauconitic, fossiliferous.

		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
180	20	Marl, bluish-gray, clayey, glauconitic, fossiliferous.
200	20	Marl, light-greenish-gray, sandy, fossiliferous.
216	16	Marl, light-grayish-green, silty, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
250	34	Clay, dark-brown, silty, carbonaceous.
260	10	Sand, brown, very fine-grained, clayey.
280	20	Sand, brown, fine-grained, clayey, lignitic.

AN-22

Location: Near center east line SE/4, SW/4, NW/4, Sec. 26, T.2 N., R.15 E. On hilltop on road to abandoned oil site.

Elevation: 310 feet (Topographic map) Date: February 2, 1977

Purpose: Drilled 350 feet for stratigraphic information. Electrical log from 0 to 348 feet.

Depth	Thickness	Description
		Claiborne Group (Cockfield Formation)
10	10	Sand, dark-reddish-brown, fine- to medium-grained, clayey.
20	10	Sand, dark-red, fine- to medium-grained, clayey.
30	10	Sand, grayish-yellow, very fine-grained, clayey.
58	28	Sand, yellowish-orange, medium- to coarse-grained, clayey.
68	10	Sand, yellowish-orange, very fine-grained, clayey.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
84	16	Clay, dark-greenish-gray, silty, carbonaceous.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
100	16	Clay, greenish-gray, silty, marly, fossiliferous, glauconitic.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
125	25	Marl, light-greenish-gray to light-bluish-gray, clayey, fossiliferous, glauconitic.
140	15	Marl, light-gray, clayey, fossiliferous.
156	16	Marl, light-greenish-gray, silty, fossiliferous, glauconitic.
		Claiborne Group (Kosciusko Formation)
170	14	Clay, dark-greenish-gray, silty, glauconitic.
180	10	Sand, dark-greenish-gray, very fine-grained, clayey.
210	30	Sand, greenish-gray, coarse-grained, clay streaks, lignitic.
230	20	Sand, dark-brown to black, fine-grained, clayey, lignitic.
250	20	Sand, light-brown, medium- to coarse-grained, clayey, lignitic.
300	50	Sand, light-yellowish-brown, fine- to medium-grained, clayey.
323	23	Sand, light-yellowish-brown, fine-grained, clay streaks, gray.
		Claiborne Group (Zilpha Formation)
344	21	Clay, dark-brown, silty, carbonaceous.
		Claiborne Group (Winona Formation)
350	6	Clay, greenish-gray, silty, glauconitic.

AN-23

Location: Near center SE/4, Sec. 8, T.2 N., R.16 E. 1.2 miles north of main road on west side of road at edge of clear cut.

Elevation: 360 feet (Topographic map) Date: February 7, 1977

Purpose: Drilled 310 feet for stratigraphic information. Electrical log from 0 to 306 feet.

Depth	Thickness	Description
		Claiborne Group (Cockfield Formation)
12	12	Sand, reddish-orange, fine-grained, clayey.
29	17	Sand, yellowish-orange, fine-grained, streaks of white sand, fine-grained.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
65	36	Clay, dark-greenish-gray, silty.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
82	17	Marl, light-greenish-gray to grayish-green, sandy, glauconitic, fossiliferous.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
108	26	Marl, limestone, bluish-gray, sandy, glauconitic, fossiliferous.
142	34	Marl, bluish-gray to light-greenish-gray, sandy, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
160	18	Clay, brown to greenish-gray, silty to sandy, glauconitic, fossiliferous.
173	13	Clay, brown, sandy streaks, lignitic.
180	7	Sand, brown, fine- to medium-grained, clayey.
210	30	Sand, brown, fine- to medium-grained, clayey, lignitic.
247	37	Sand, light-brown, fine- to medium-grained, clayey, lignitic.
270	23	Sand, brownish-gray, coarse-grained.
		Claiborne Group (Zilpha Formation)
298	28	Clay, dark-greenish-gray, glauconitic, fossiliferous.
		Claiborne Group (Winona Formation)
310	12	Sand, greenish-gray, fine-grained, clayey, glauconitic, fossiliferous.

AN-24

Location: NW/4, NW/4, NW/4, Sec. 25, T.3 N., R.16 E. 0.3 mile east of State Highway 18 on hilltop of Billy Goat Mountain Road.

Elevation: 400 feet (Topographic map) Date: February 8, 1977

Purpose: Drilled 330 feet for stratigraphic information. Electrical log from 0 to 328 feet.

Depth	Thickness	Description
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
10	10	Sand, reddish-orange to dark-reddish-brown, fine- to medium-grained, clayey.
20	10	Sand, yellowish-orange, fine- to medium-grained, clayey, glauconitic.
28	8	Sand, yellowish-orange, fine-grained, clay, grayish-yellow, glauconitic, fossiliferous.
41	13	Clay, light-greenish-gray, marly, sandy, glauconitic, fossiliferous.

		Claiborne Group (Kosciusko Formation)
52	11	Clay, dark-green, sandy, glauconitic.
70	18	Sand, light-grayish-yellow, medium-grained, clayey, carbonaceous.
90	20	Clay, yellowish-gray, fine-grained sand streaks.
100	10	Sand, light-yellow, fine-grained, clayey.
130	30	Sand, brown to grayish-brown, fine-grained, clayey, carbonaceous.
150	20	Sand, light-brownish-yellow, fine- to coarse-grained.
		Claiborne Group (Zilpha Formation)
160	10	Clay, dark-green, sandy, glauconitic.
169	9	Clay, grayish-brown, silty.
		Claiborne Group (Winona Formation)
182	13	Sand, greenish-gray, fine-grained, marly, glauconitic, fossiliferous, partially indurated.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
194	12	Sand, grayish-green, very fine-grained, clayey.
210	16	Clay, green to grayish-green, silty.
224	14	Sand, greenish-gray, very fine-grained, clayey, glauconitic.
308	84	Clay, greenish-gray to green, claystone and sandstone, glauconitic.
		Claiborne Group (Tallahatta Formation—Meridian Sand member)
330	22	Sand, light-gray, medium- to coarse-grained, clayey.

AN-25

Location: NW/4, NW/4, SE/4, Sec. 9, T.3 N., R.17 E.

Elevation: 435 feet (Topographic map) Date: February 9, 1977

Purpose: Drilled 340 feet for stratigraphic information. Electrical log from 0 to 335 feet.

Depth	Thickness	Description
		Claiborne Group (Kosciusko Formation)
30	30	Sand, yellowish-orange, medium- to coarse-grained.
40	10	Sand, light-yellow, fine- to coarse-grained, clayey.
		Claiborne Group (Zilpha Formation)
45	5	Clay, yellowish-brown to gray, silty.
60	15	Clay, dark-brown to grayish-brown, silty, glauconitic, carbonaceous.
		Claiborne Group (Winona Formation)
68	8	Sand, dark-green to greenish-gray, clayey, glauconitic, fossiliferous.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
80	12	Clay, light-gray to light-greenish-gray, silty.
170	90	Clay, claystone, light-gray, silty.
		Claiborne Group (Tallahatta Formation—Meridian Sand member)
176	6	Sand, light-greenish-gray, medium- to coarse-grained, lignitic.
190	14	Sand, very-light-gray, medium- to coarse-grained, lignitic.
202	12	Sand, light-gray to light-brown, medium-grained, clayey, carbonaceous.
		Wilcox Group (Hatchetigbee Formation)

220	18	Clay, grayish-brown, sandy, carbonaceous.
227	7	Clay, gray, sandy, carbonaceous.
275	48	Sand, light-gray, fine-grained, clayey, carbonaceous.
290	15	Clay, greenish-gray, sandy, carbonaceous.
300	10	Silt, greenish-gray, sandy, glauconitic, carbonaceous.
340	40	Clay, light-gray, silty, carbonaceous.

AN-26

Location: SW/4, NW/4, SW/4, Sec. 25, T.4 N., R.17 E. Hilltop 0.3 mile east of Piney Woods and Fuller Roads intersection.

Elevation: 500 feet (Topographic map) Date: February 10, 1977

Purpose: Drilled 300 feet for stratigraphic information. Electrical log from 0 to 299 feet.

Depth	Thickness	Description
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
17	17	Claystone, clay, yellowish-gray, silty.
30	13	Claystone, clay, green to greenish-gray, silty.
50	20	Clay, claystone, light-grayish-green, silty.
55	5	Clay, claystone, light-yellowish-gray, silty.
68	13	Claystone, clay, green to light-greenish-gray.
		Claiborne Group (Tallahatta Formation—Meridian Sand member)
85	17	Sand, orangish-gray, fine- to coarse-grained, clayey, carbonaceous.
100	15	Sand, light-yellowish-gray, fine- to medium-grained.
130	30	Sand, light-yellowish-gray, coarse-grained, ferruginous.
		Wilcox Group (Hatchetigbee Formation)
147	17	Sand, dark-brown to black, fine- to medium-grained, clayey, lignitic.
163	16	Sand, orangish-gray to gray, fine- to coarse-grained, clayey.
180	17	Silt, dark-green to greenish-gray, sandy, clayey, glauconitic, carbonaceous.
190	10	Silt, gray, sandy, clayey, carbonaceous.
215	25	Clay, gray, silty, carbonaceous.
220	5	Clay, dark-brown to black, lignitic.
240	20	Silt, light-gray, clayey.
247	7	Silt, brown to grayish-brown, clayey, carbonaceous.
250	3	Clay, dark-brown to black, lignitic.
258	8	Silt, bluish-gray to light-greenish-gray, clayey.
300	42	Clay, gray, silty, carbonaceous.

AN-27

Location: SE/4, NW/4, SW/4, SE/4, Sec. 17, T.4 N., R.18 E.

Elevation: 420 feet (Topographic map) Date: February 14, 1977

Purpose: Drilled 200 feet for stratigraphic information. Electrical log from 0 to 199 feet.

Depth	Thickness	Description
		Wilcox Group (Hatchetigbee Formation)
10	10	Silt, yellowish-gray, clayey, ferruginous.
18	8	Silt, gray to dark-gray, clayey.
32	14	Silt, yellowish-gray, sandy, clayey, ferruginous.
74	42	Clay, gray, silty, carbonaceous.
110	36	Sand, grayish-yellow to light-orange, fine- to medium-grained.
120	10	Sand, orange, coarse-grained, clayey, carbonaceous streaks.
125	5	Sand, gray, fine- to medium-grained.

167	42	Silt, light-gray, clayey, carbonaceous.
173	6	Clay, gray to greenish-gray, silty.
		Wilcox Group (Bashi Formation)
182	9	Sand, light-gray, fine-grained, clayey, marly, glauconitic, fossiliferous.
		Wilcox Group (Tuscahoma Formation)
200	18	Clay, brownish-gray, silty, lignitic.

AN-28

Location: Near center SE/4, NE/4, NE/4, NE/4, Sec. 9, T.4 N., R.18 E.

Elevation: 410 feet (Topographic map) Date: February 14, 1977

Purpose: Drilled 96 feet for stratigraphic information. Electrical log from 0 to 95 feet.

Depth	Thickness	Description
		Wilcox Group (Hatchetigbee Formation)
10	10	Sand, orangish-yellow, fine-grained, clayey.
30	20	Sand, light-gray to yellowish-gray, fine-grained, clayey.
76	46	Sand, greenish-yellow to orangish-yellow, very fine-grained, clayey.
93	17	Clay, dark-gray, carbonaceous.
		Wilcox Group (Bashi Formation)
96	3	Marl, greenish-gray, sandy, glauconitic, fossiliferous.

AN-29

Location: NE/4, NE/4, SW/4, NW/4, Sec. 20, T.3 N., R.17 E.

Elevation: 290 feet (Topographic map) Date: February 15, 1977

Purpose: Drilled 40 feet to determine thickness of alluvium in Bucatunna Creek. No electrical log.

Depth	Thickness	Description
		Alluvium
8	8	Clay, dark-brown to yellowish-brown, silty.
20	12	Sand, very-light-gray, fine- to coarse-grained, gravelly.
30	10	Sand, light-gray, fine- to coarse-grained, pea gravel, weathered claystone fragments (rounded).
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
40	10	Clay, claystone, light-gray to light-greenish-gray.

AN-30

Location: NW/4, NW/4, SW/4, SE/4, NW/4, Sec. 21, R.4 N., R.18 E.

Elevation: 600 feet (Topographic map) Date: February 16, 1977

Purpose: Drilled 70 feet for stratigraphic information. No electrical log.

Depth	Thickness	Description
		Claiborne Group (Winona (?) Formation)
20	20	Sand, reddish-orange, fine- to medium-grained, clayey, ferruginous.

		Claiborne Group (Tallahatta Formation—Basic City Shale member)
30	10	Clay, yellowish-orange to light-grayish-yellow.
38	8	Clay, light-greenish-yellow to light-yellow, silty, indurated streaks.
70	32	Clay, claystone, light-gray to gray.

AN-31

Location: SE/4, NE/4, NW/4, Sec. 24, T.3 N., R.16 E. 0.15 mile east of road intersection.

Elevation: 295 feet (Topographic map) Date: February 28, 1977

Purpose: Drilled 80 feet for stratigraphic information. Electrical log from 0 to 77 feet.

Depth	Thickness	Description
		Alluvium
14	14	Sand, gray to yellowish-orange, very fine- to coarse-grained, clayey, gravelly.
24	10	Sand, light-gray, very fine- to coarse-grained, clayey, weathered claystone fragments.
34	10	Sand, very light-gray to grayish-green, clayey, gravelly, claystone fragments.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
40	6	Clay, gray to greenish-gray.
58	18	Clay, claystone, light-gray.
70	12	Clay, claystone, greenish-gray, glauconitic.
80	10	Clay, claystone, gray to greenish-gray.

AN-32

Location: Center SW/4, SE/4, SW/4, Sec. 21, T.3 N., R.18 E.

Elevation: 415 feet (Topographic map) Date: March 1, 1977

Purpose: Drilled 161 feet for stratigraphic information. Electrical log from 0 to 160 feet.

Depth	Thickness	Description
		Claiborne Group (Kosciusko Formation)
20	20	Sand, yellowish-orange, fine- to medium-grained, clayey.
35	15	Sand, yellow, medium- to coarse-grained, clayey.
		Claiborne Group (Zilpha Formation)
44	9	Clay, gray, silty, carbonaceous.
54	10	Clay, grayish-brown to greenish-gray, silty, glauconitic.
		Claiborne Group (Winona Formation)
62	8	Sand, greenish-gray, very-fine-grained, clayey, glauconitic, fossiliferous.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
100	38	Clay, claystone, light-gray to light-greenish-gray, glauconitic.
161	61	Claystone, clay, light-gray.

AN-33

Location: SE/4, NE/4, NW/4, Sec. 9, T.3 N., R.18 E.

Elevation: 520 feet (Topographic map) Date: March 1, 1977

Purpose: Drilled 100 feet for stratigraphic information. Electrical log from 0 to 99 feet.

Depth	Thickness	Description
		Claiborne Group (Kosciusko Formation)
10	10	Sand, reddish-orange, medium-grained, clayey.
20	10	Sand, yellowish-orange to brownish-yellow, fine- to medium-grained, clayey, ferruginous.
45	25	Sand, orangish-yellow, fine-grained, clayey.
		Claiborne Group (Zilpha Formation)
56	11	Clay, dark-greenish-gray, sandy, glauconitic, carbonaceous.
		Claiborne Group (Winona Formation)
62	6	Sand, light-greenish-gray, very-fine-grained, clayey, glauconitic, fossiliferous.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
80	18	Clay, claystone, light-gray to light-greenish-gray, glauconitic.
100	20	Clay, claystone, bluish-gray to greenish-gray.

AN-34

Location: SE/4, NW/4, SE/4, Sec. 33, T.4 N., R.18 E.

Elevation: 512 feet (Topographic map) Date: March 2, 1977

Purpose: Drilled 330 feet for stratigraphic information. Electrical log from 0 to 330 feet.

Depth	Thickness	Description
		Claiborne Group (Winona Formation)
10	10	Sand, reddish-orange, fine- to medium-grained, ferruginous.
20	10	Sand, yellowish-orange, fine- to medium-grained, glauconitic, ferruginous.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
25	5	Clay, light-greenish-gray, silty.
30	5	Clay, light-greenish-gray, silty, claystone, carbonaceous.
38	8	Clay, claystone, light-greenish-gray.
85	47	Clay, claystone, light-grayish-green to light-greenish-gray, silty, glauconitic.
97	12	Clay, claystone, green to light-greenish-gray silt.
		Claiborne Group (Tallahatta Formation—Meridian Sand member)
120	23	Sand, very light-gray, medium- to coarse-grained, clayey streaks.
126	6	Sand, light-gray, fine- to coarse-grained, clayey, lignitic.
		Wilcox Group (Hatchetigbee Formation)
145	19	Clay, gray, sandy, glauconitic, carbonaceous.
178	33	Clay, gray to greenish-gray, sandy, carbonaceous.
184	6	Clay, light-gray to greenish-gray, glauconitic.
208	24	Clay, gray, silty, carbonaceous.
221	13	Silt, light-gray to brownish-gray, clayey, sandy, lignitic.
230	9	Clay, light-gray to grayish-brown, silty, carbonaceous.
242	12	Clay, green to grayish-green, silty, carbonaceous.
250	8	Clay, brownish-gray to dark-gray, silty, lignitic.
260	10	Clay, light-greenish-gray to brownish-gray, silty, sandy, lignitic.

288	28	Clay, gray, silty.
300	12	Clay, greenish-gray, sandy, glauconitic.
330	30	Clay, gray to greenish-gray, sandy, glauconitic, carbonaceous.

AN-35

Location: NW/4, SE/4, SE/4, Sec. 7, T.2 N., R.18 E.

Elevation: 395 feet (Topographic map) Date: March 7, 1977

Purpose: Drilled 330 feet for stratigraphic information. Electrical log from 0 to 328 feet.

Depth	Thickness	Description
		Claiborne Group (Cook Mountain Formation—Potterchitto and Archusa Marl members, undifferentiated)
15	15	Sand, yellowish-orange to reddish-orange, very fine-grained, clayey, ferruginous.
30	15	Sandy, grayish-yellow, very fine-grained, clayey, glauconitic.
64	34	Marl, bluish-gray, sandy, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
76	12	Clay, bluish-gray, shaly.
86	10	Clay, grayish-brown, sandy, carbonaceous, fossiliferous.
94	8	Sand, brown, fine-grained, clayey, carbonaceous.
112	18	Sand, brown to black, fine-grained, clayey, lignitic.
120	8	Sand, black, fine-grained, clayey, lignitic (black, hard).
154	34	Sand, dark-brown to black, fine-grained, clayey, lignitic.
		Claiborne Group (Zilpha Formation)
170	16	Clay, dark-gray to dark-greenish-gray, silty, glauconitic.
		Claiborne Group (Winona Formation)
178	8	Clay, dark-gray to brownish-gray, silty, glauconitic, fossiliferous.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
190	12	Clay, light-greenish to bluish-gray, sandy, glauconitic, indurated streaks.
210	20	Clay, greenish-gray, silty, sandy, claystone.
226	16	Clay, grayish-green, silty, indurated streaks.
256	30	Clay, claystone, grayish-green, silty.
317	61	Claystone, clay, green, silty.
330	13	Clay, grayish-green, silty, sandy, glauconitic.

AN-36

Location: NE/4, NE/4, SW/4, Sec. 6, T.3 N., R.17 E. On hilltop.

Elevation: 400 feet (Topographic map) Date: March 8, 1977

Purpose: Drilled 170 feet for stratigraphic information. Electrical log from 0 to 168 feet.

Depth	Thickness	Description
		Claiborne Group (Zilpha-Winona Formation(s))
6	6	Sand, yellowish-orange, medium- to coarse-grained, clayey, ferruginous.
14	8	Clay, yellowish-brown, sandy, ferruginous.
20	6	Silt, dark-greenish-gray to brownish-gray, clayey, glauconitic.
24	4	Sandstone, sand, brownish-green to yellowish-gray, glauconitic, fossiliferous.

		Claiborne Group (Tallahatta Formation—Basic City Shale member)
50	26	Clay, green to grayish-green, silty, glauconitic.
80	30	Clay, claystone, grayish-green, silty, glauconitic.
120	40	Claystone, clay, light-gray to light-greenish-gray, silty.
130	10	Clay, claystone, light-grayish-green, silty, glauconitic.
		Claiborne Group (Tallahatta Formation—Meridian Sand member)
138	8	Sand, grayish-brown, fine-grained, clayey, carbonaceous.
158	20	Sand, grayish-brown, very fine-grained, clayey.
170	12	Sand, grayish-brown, fine-grained, clayey, carbonaceous.

AN-37

Location: SW/4, SE/4, SW/4, Sec. 35, T.4 N., R.16 E.

Elevation: 320 feet (Topographic map) Date: March 8, 1977

Purpose: Drilled 170 feet for stratigraphic information. Electrical log from 0 to 169 feet.

Depth	Thickness	Description
		Alluvium
10	10	Sand, grayish-yellow, fine- to medium-grained, clayey.
15	5	Sand, light-gray, fine- to coarse-grained, gravel.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
50	35	Claystone, clay, light-gray.
60	10	Clay, claystone, light-greenish-gray, glauconitic.
83	23	Claystone, clay, light-gray, silty.
		Claiborne Group (Tallahatta Formation—Meridian Sand member)
100	17	Sand, light-gray, fine- to coarse-grained, clay streaks, brown, carbonaceous.
119	19	Sand, very light gray, fine- to medium-grained, clay streaks, brown to brownish-black, lignitic.
135	16	Sand, light-greenish-gray, fine- to medium-grained, clay streaks, carbonaceous.
		Wilcox Group (Hatchetigbee Formation)
140	5	Clay, gray to greenish-gray, sandy, carbonaceous.
170	30	Clay, greenish-gray, sandy, glauconitic, carbonaceous.

AN-38

Location: SW/4, SE/4, SW/4, Sec. 24, T.4 N., R.15 E.

Elevation: 420 feet (Topographic map) Date: March 9, 1977

Purpose: Drilled 120 feet for stratigraphic information. Electrical log from 0 to 117 feet.

Depth	Thickness	Description
		Claiborne Group (Kosciusko Formation)
10	10	Sand, reddish-orange, fine-grained, clayey.
20	10	Sand, yellowish-orange, fine-grained, clayey.
30	10	Clay, yellowish-gray, sand streaks, ferruginous.
40	10	Sand, light-yellow, fine- to medium-grained.
50	10	Sand, very-light-yellow, fine-grained, clay streaks.

60	10	Sand, white, fine-grained.
70	10	Sand, light-yellow, fine- to medium-grained.
92	22	Sand. Based on electrical log. No sample.
		Claiborne Group (Zilpha Formation)
110	18	Clay. Based on electrical log. No sample.
120	10	Clay, dark-greenish-gray, silty. Sample taken from drill bit.

AN-39

Location: SE/4, SE/4, SW/4, Sec. 22, T.3 N., R.16 E. On International Paper Co. road 1.25 miles from gravel road.

Elevation: 440 feet (Topographic map) Date: March 16, 1977

Purpose: Drilled 270 feet for stratigraphic information. Electrical log from 0 to 269 feet.

Depth	Thickness	Description
		Terrace Deposit
10	10	Sand, reddish-brown, fine-grained, clayey.
20	10	Sand, orangish-yellow, fine-grained, clayey.
28	8	Sand, light-yellow, fine-grained, clayey.
		Claiborne Group (Cook Mountain Formation—Potterchitto and Archusa Marl members, undifferentiated)
40	12	Clay, grayish-yellow to yellowish-brown, silty.
63	23	Clay, yellowish-brown, orangish-yellow, reddish-orange, sandy.
70	7	Clay, gray to greenish-gray, marly, fossiliferous.
86	16	Marl, gray, sandy, fossiliferous.
88	2	Limestone, yellowish-gray, sandy, fossiliferous.
104	16	Marl, light-greenish-gray, sandy, fossiliferous, glauconitic.
		Claiborne Group (Kosciusko Formation)
111	7	Sand, light-brownish-gray, medium- to coarse-grained.
120	9	Clay, dark-greenish-gray, silty, sandy.
140	20	Sand, brownish-gray, coarse-grained, clayey, lignitic.
150	10	Sand, brownish-gray to black, medium- to coarse-grained, lignitic.
185	35	Clay, gray, sand streaks.
192	7	Clay, black, lignitic.
219	27	Sand, brownish-gray to black, fine- to coarse-grained, clayey, lignitic.
		Claiborne Group (Zilpha Formation)
240	21	Clay, brown to grayish-brown, silty.
		Claiborne Group (Winona Formation)
250	10	Sand, greenish-gray to dark-green, very fine-grained, clayey, glauconitic, fossiliferous, partially indurated.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
270	20	Clay, light-grayish-green, silty, glauconitic.

AN-40

Location: NW/4, SW/4, SE/4, Sec. 20, T.3 N., R.16 E. 0.3 mile southeast of the intersection.

Elevation: 295 feet (Topographic map) Date: March 16, 1977

Purpose: Drilled 130 feet for stratigraphic information. Electrical log from 2 to 128 feet.

Depth	Thickness	Description
		Alluvium
8	8	Clay, yellowish-orange to gray, sandy.
15	7	Sand, light-gray, fine- to coarse-grained, gravel.
		Claiborne Group (Kosciusko Formation)
17	2	Clay, light-gray to gray, carbonaceous.
30	13	Sand, very-light-gray, fine- to medium-grained, clay streaks.
50	20	Sand, light-gray, fine- to coarse-grained, clay streaks.
60	10	Sand, white to light-gray, medium- to coarse-grained, lignitic.
73	13	Sand, light-gray, medium- to coarse-grained, clay streaks, grayish-brown, lignitic.
75	2	Lignite, dark-gray to black, clayey.
84	9	Sand, brownish-gray, medium- to coarse-grained, lignitic.
		Claiborne Group (Zilpha Formation)
96	12	Clay, dark-gray to dark-greenish-gray, silty.
100	4	Clay, light-greenish-gray, silty, glauconitic.
		Claiborne Group (Winona Formation)
103	3	Sand, light-greenish-gray, fine-grained, clayey, glauconitic, fossiliferous.
107	4	Sandstone, light-greenish-gray, fine-grained, clayey, glauconitic, fossiliferous.
114	7	Sandstone, greenish-yellow, fine-grained, glauconitic, fossiliferous.
120	6	Sand, light-greenish-gray, fine-grained, clayey, glauconitic, fossiliferous.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
130	10	Clay, light-gray to light-greenish-gray, silty, sandy, glauconitic.

AN-41

Location: NE/4, NW/4, NE/4, Sec. 32, T.4 N., R.16 E. On the south side of Crandel Road, 0.3 mile east of Highway 45.

Elevation: 440 feet (Topographic map) Date: March 17, 1977

Purpose: Drilled 210 feet for stratigrapic information. Electrical log from 0 to 209 feet.

Depth	Thickness	Description
		Claiborne Group (Kosciusko Formation)
14	14	Clay, reddish-brown, sandy.
20	6	Sand, reddish-yellow to reddish-brown, fine-grained, clayey.
32	12	Sand, reddish-brown, fine-grained, clayey, ferruginous.
40	8	Sand, reddish-brown, fine-grained, clayey.
58	18	Sand, orangish-brown, fine- to medium-grained, clay streaks.
60	2	Clay, light-yellowish-gray.
80	20	Sand, reddish-orange, fine-grained, clay streaks, yellowish-gray.
90	10	Sand, reddish-orange, fine- to coarse-grained.
134	44	Sand, very-light-yellow to light-orange, fine- to coarse-grained, clay streaks, yellow to gray.
		Claiborne Group (Zilpha Formation)
140	6	Clay, dark-greenish-gray, sandy, glauconitic.
150	10	Clay, dark-greenish-gray to dark-gray, silty.

		Claiborne Group (Winona Formation)
165	15	Sandstone, sand, dark-green to greenish-yellowish-gray, glauconitic, fossiliferous.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
170	5	Clay, light-gray to light-greenish-gray, silty, glauconitic.
182	12	Sand, light-greenish-gray, medium-grained, clay streaks.
190	8	Clay, light-greenish-gray, silty, glauconitic.
200	10	Clay, claystone, light-gray to light-greenish-gray, glauconitic.
210	10	Clay, claystone, light-greenish-gray.

AN-42

Location: SE/4, SW/4, NW/4, Sec. 21, T.4 N., R.15 E. Center of logging road approximately 250 feet south of State Highway 514.

Elevation: 465 feet (Topographic map) Date: March 17, 1977

Purpose: Drilled 200 feet for stratigraphic information. Electrical log from 0 to 200 feet.

Depth	Thickness	Description
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
10	10	Sand, reddish-orange, fine-grained, clayey.
		Claiborne Group (Kosciusko Formation)
21	11	Silt, orangish-yellow to grayish-yellow, clayey.
30	9	Silt, grayish-yellow to greenish-yellow, clayey.
37	7	Clay, greenish-yellow, silty, glauconitic.
44	7	Clay, reddish-brown, silty, shaly.
50	6	Clay, dark-grayish-green, silty.
70	20	Clay, dark-brown to grayish-brown, sandy, silty, carbonaceous.
84	14	Sand, orangish-yellow, fine-grained, clay streaks, silty, grayish-brown.
100	16	Sand, orange to orangish-gray, coarse-grained.
125	25	Sand, brownish-gray to orangish-gray, medium- to coarse-grained, clayey.
140	15	Sand, yellowish-gray, medium-grained.
		Claiborne Group (Zilpha Formation)
152	12	Clay, dark-green to grayish-green, silty, glauconitic.
168	16	Clay, brownish-gray.
		Claiborne Group (Winona Formation)
188	20	Sand, sandstone, grayish-green, very fine-grained, glauconitic, fossiliferous.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
200	12	Clay, claystone, greenish-gray.

AN-43

Location: Near center S/2, SE/4, NE/4, Sec. 6, T.4 N., R.14 E.

Elevation: 400 feet (Topographic map) Date: March 22, 1977

Purpose: Drilled 250 feet for stratigraphic information. Electrical log from 0 to 249 feet.

Depth	Thickness	Description
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)

10	10	Clay, orangish-yellow to grayish-yellow, silty, glauconitic.
17	7	Clay, yellowish-gray, silty, glauconitic.
		Claiborne Group (Kosciusko Formation)
100	83	Sand, light-gray, fine- to medium-grained, clay streaks, light-gray to yellowish-gray.
110	10	Sand, light-gray, fine- to medium-grained.
130	20	Sand, light-yellowish-gray, medium- to coarse-grained.
150	20	Sand, greenish-gray, medium- to coarse-grained; clay streaks, lignitic.
160	10	Sand, dark-greenish-gray, fine-grained, clayey, carbonaceous.
		Claiborne Group (Zilpha Formation)
175	15	Clay, dark-green to grayish-green, silty, glauconitic.
193	18	Clay, grayish-brown, silty.
200	7	Silt, light-gray, clayey.
		Claiborne Group (Winona Formation)
218	18	Sand, sandstone, grayish-green to green, fine-grained, glauconitic, fossiliferous.
238	20	Sand, green, coarse-grained, glauconitic, fossiliferous.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
250	12	Clay, light-greenish-gray to gray, silty, glauconitic.

AN-44

Location: SE/4, SE/4, SW/4, Sec. 12, T.4 N., R.14 E. South side of highway 0.25 mile east of Chunky River Bridge on Highway 11.

Elevation: 250 feet (Topographic map) Date: March 22, 1977

Purpose: Drilled 200 feet for stratigraphic information. Electrical log from 0 to 199 feet.

Depth	Thickness	Description
6	6	Road embankment
		Alluvium
18	12	Clay, light-gray, silty, sandy,
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
26	8	Claystone, yellowish-orange, sandy.
40	14	Claystone, sandstone, grayish-green to light-gray, clayey, glauconitic.
100	60	Clay, claystone, sandstone, grayish-green to light-gray, glauconitic.
130	30	Claystone, clay, light-gray to light-greenish-gray, silty.
140	10	Clay, claystone, light-gray, silty.
146	6	Clay, light-gray to light-greenish-gray, silty, glauconitic.
155	9	Clay, light-gray, silty, sandy.
		Claiborne Group (Tallahatta Formation—Meridian Sand member)
170	15	Sand, light-gray to brownish-gray, fine- to medium-grained, clayey, carbonaceous.
195	25	Sand, light-gray to light-brownish-gray, fine-grained, clayey, lignitic.
		Wilcox Group (Hatchetigbee Formation)
200	5	Clay, brown, sandy, lignitic.

AN-45

Location: NE/4, SW/4, NE/4, Sec. 29, T.4 N., R.14 E.

Elevation: 390 feet (Topographic map) Date: March 23, 1977

Purpose: Drilled 300 feet for stratigraphic information. Electrical log from 0 to 299 feet.

Depth	Thickness	Description
		Terrace Deposit
13	13	Sand, yellowish-orange, fine-grained, clayey.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
26	13	Clay, yellowish-gray to orangish-red.
40	14	Clay, grayish-green, silty, glauconitic.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
44	4	Clay, greenish-gray to dark-green, sandy, glauconitic, fossiliferous.
50	6	Clay, yellowish-gray to orangish-brown, sandy, glauconitic, fossiliferous.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
73	23	Marl, light-gray to greenish-gray, sandy, glauconitic, fossiliferous.
84	11	Clay, greenish-gray to light-grayish-green, marly, glauconitic, fossiliferous.
92	8	Clay, light-grayish-green, sandy, glauconitic, fossiliferous.
100	8	Marl, light-greenish-gray, clayey, glauconitic, fossiliferous.
109	9	Marl, gray to greenish-gray, silty, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
118	9	Sand, dark-brown to black, fine-grained, clayey, lignitic.
160	42	Sand, brown to black, fine-grained; clay streaks, lignitic.
172	12	Sand, brown, fine-grained, clayey.
200	28	Clay, brownish-gray, sand streaks.
245	45	Sand, light-brownish-gray to grayish-brown, fine-grained, clayey, lignitic.
		Claiborne Group (Zilpha Formation)
260	15	Clay, dark-greenish-gray, sandy, glauconitic.
265	5	Clay, greenish-brown, sandy, glauconitic.
274	9	Sand, dark-green, very-fine-grained, clayey, glauconitic, fossiliferous.
287	13	Clay, brown, silty.
		Claiborne Group (Winona Formation)
300	13	Sandstone, grayish-green, very fine-grained, glauconitic, fossiliferous.

AN-46

Location: NW/4, SW/4, SE/4, Sec. 27, T.3 N., R.14 E.

Elevation: 360 feet (Topographic map) Date: March 23, 1977

Purpose: Drilled 100 feet for stratigraphic information. Electrical log from 0 to 98 feet.

Depth	Thickness	Description
		Terrace Deposit
10	10	Sand, yellowish-brown, fine- to medium-grained, clayey.
19	9	Sand, light-yellowish-gray, medium-grained, gravel.

		Jackson Group (Yazoo Formation—North Twistwood Creek Clay member)
24	5	Clay, yellowish-gray to light-gray.
40	16	Clay, light-gray, fossiliferous.
76	36	Clay, light-greenish-gray, fossiliferous.
		Jackson Group (Moodys Branch Formation)
86	10	Marl, greenish-gray, sandy, fossiliferous.
		Claiborne Group (Cockfield Formation)
90	4	Clay, dark-brown to black, silty, carbonaceous.
100	10	Clay, light-gray to gray, silty, carbonaceous.

AN-47

Location: SE/4, SW/4, NW/4, Sec. 17, T.2 N., R.15 E.

Elevation: 245 feet (Topographic map) Date: March 28, 1977

Purpose: Drilled 290 feet for stratigraphic information. Electrical log from 0 to 285 feet.

Depth	Thickness	Description
		Claiborne Group (Cockfield Formation)
15	15	Sand, light-reddish-orange, fine- to coarse-grained, clayey.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
30	15	Clay, dark-greenish-gray, silty, glauconitic.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
48	18	Marl, light-grayish-green to dark-greenish-gray, sandy, glauconitic, fossiliferous.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
67	19	Marl, limestone lenses, light-greenish-gray, silty, glauconitic, fossiliferous.
84	17	Marl, greenish-gray, silty, glauconitic, fossiliferous.
90	6	Limestone, light-greenish-gray, silty, fossiliferous.
106	16	Clay, grayish-green, marly, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
120	14	Clay, brown, sandy.
142	22	Sand, greenish-gray, fine-grained, clayey, lignitic.
216	74	Sand, brownish-gray to greenish-gray, very-fine-grained, clay streaks, carbonaceous.
240	24	Sand, brownish-gray, fine-grained, clayey, lignitic.
272	32	Sand, light-brownish-gray, medium- to coarse-grained, clayey, lignitic.
		Claiborne Group (Zilpha Formation)
290	18	Clay, brownish-gray to brownish-green, silty, glauconitic.

AN-48

Location: SW/4, NW/4, SW/4, Sec. 23, T.3 N., R.15 E.

Elevation: 300 feet (Topographic map) Date: March 29, 1977

Purpose: Drilled 200 feet for stratigraphic information. Electrical log from 0 to 199 feet.

Depth	Thickness	Description
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
5	5	Clay, reddish-orange, silty.
10	5	Clay, light-yellowish-brown, silty, glauconitic.
20	10	Clay, brownish yellow to yellowish-gray, sandy, glauconitic.
25	5	Clay, dark-grayish-green, silty, glauconitic.
		Claiborne Group (Kosciusko Formation)
46	21	Sand, yellow to light-brown, fine-grained, clayey, ferruginous.
49	3	Clay, dark-brown, carbonaceous.
60	11	Clay, greenish-gray to gray, silty, carbonaceous.
68	8	Clay, light-yellowish-brown, silty.
77	9	Clay, gray, silty.
100	23	Sand, light-gray, fine-grained, clay streaks, lignitic.
120	20	Sand, light-gray, fine- to medium-grained, silty, clay streaks, lignitic.
130	10	Sand, light-gray, medium-grained, lignitic.
159	29	Sand, light-gray, medium- to coarse-grained, clayey, carbonaceous.
		Claiborne Group (Zilpha Formation)
174	15	Clay, dark-green, silty, glauconitic.
186	12	Clay, grayish-brown.
		Claiborne Group (Winona Formation)
190	4	Clay, greenish-gray, silty, glauconitic, fossiliferous.
200	10	Sand, greenish-gray to grayish-green, fine-grained, clayey, glauconitic, fossiliferous.

AN-49

Location: Center NE/4, SE/4, Sec. 11, T.1 N., R.17 E. 0.8 mile north of paved road.

Elevation: 235 feet (Topographic map) Date: March 29, 1977

Purpose: Drilled 110 feet for stratigraphic information. Electrical log from 0 to 109 feet.

Depth	Thickness	Description
		Alluvium
10	10	Clay, gray, silty.
20	10	Sand, light-gray, fine- to medium-grained, clayey.
		Jackson Group (Yazoo Formation—North Twistwood Creek Clay member)
53	33	Clay, light-green, fossiliferous.
		Jackson Group (Moodys Branch Formation)
68	15	Marl, greenish-gray, sandy, glauconitic, fossiliferous.
		Claiborne Group (Cockfield Formation)
82	14	Clay, brownish-gray, sandy, glauconitic, carbonaceous.
90	8	Sand, brownish-gray, fine-grained, clayey.
110	20	Sand, gray, fine-grained, lignitic.

AN-50

Location: NW/4, SW/4, NW/4, Sec. 23, T.2 N., R.16 E. On hilltop on west side of road 0.55 mile from State Highway 511.

Elevation: 360 feet (Topographic map) Date: April 20, 1977

Purpose: Drilled 230 feet for stratigraphic information. Electrical log from 0 to 229 feet.

Depth	Thickness	Description
		Claiborne Group (Cockfield Formation)
10	10	Sand, reddish-orange, fine-grained, clayey.
28	18	Sand, yellowish-orange, fine-grained, clayey.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
50	22	Clay, gray to brownish-gray, silty.
70	20	Clay, greenish-gray, silty.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
80	10	Marl, grayish-green, clayey, silty, glauconitic, fossiliferous.
89	9	Clay, light-green, marly, glauconitic, fossiliferous.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
98	9	Marl, light-bluish-gray to light-green clayey, glauconitic, fossiliferous.
130	32	Marl, grayish-green, silty, glauconitic, fossiliferous.
148	18	Clay, grayish-green to light-green, marly, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
160	12	Clay, gray to brownish-gray, silty.
188	28	Sand, brown to grayish-brown, fine-grained, clayey, lignitic.
204	16	Clay, brownish-gray, carbonaceous.
218	14	Sand, light-brown, fine-grained, clayey, lignitic.
230	12	Sand, light-brown, fine- to medium-grained, clay streaks, carbonaceous.

AN-51

Location: SE/4, SW/4, NE/4, Sec. 11 T.2 N., R.17 E. On east side of road 0.1 mile south of First Road and Alma Graham Road intersection.

Elevation: 360 feet (Topographic map) Date: April 20, 1977

Purpose: Drilled 200 feet for stratigraphic information. Electrical log from 0 to 199 feet.

Depth	Thickness	Description
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
10	10	Sand, reddish-orange, fine-grained, clayey.
24	14	Sand, orangish-yellow, fine-grained, clayey, glauconitic.
43	19	Marl, grayish-yellow to green, clayey, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
54	11	Clay, grayish-green, silty, fossiliferous.
62	8	Clay, dark-brown to black, sandy, lignitic.
68	6	Sand, brown, fine-grained, clayey, lignitic.
100	32	Sand, brown to black, fine- to medium-grained, clayey, lignitic.
137	37	Sand, light-brown, medium- to coarse-grained, lignitic.
		Claiborne Group (Zilpha Formation)

156	19	Clay, brownish-gray to greenish-gray, silty, glauconitic.
		Claiborne Group (Winona Formation)
172	16	Silt, greenish-gray, clayey, glauconitic, fossiliferous.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
200	28	Clay, green, silty, indurated streaks.

AN-52

Location: SW/4, SW/4, NE/4, NW/4, Sec. 27, T.1 N., R.17 E.

Elevation: 245 feet (Topographic map) Date: April 26, 1977

Purpose: Drilled 300 feet for stratigraphic information. Electrical log from 0 to 299 feet.

Depth	Thickness	Description
		Alluvium
9	9	Clay, light-gray to yellowish-orange, sandy.
		Jackson Group (Yazoo Formation—North Twistwood Creek Clay member)
15	6	Clay, yellowish-orange to orangish-brown, silty.
20	5	Clay, bluish-gray, silty, fossiliferous.
58	38	Clay, greenish-gray to gray, silty, fossiliferous.
		Jackson Group (Moodys Branch Formation)
73	15	Clay, very-light-gray to gray, marly, glauconitic, fossiliferous.
78	5	Clay, brownish-gray to gray, sandy, glauconitic, fossiliferous.
		Claiborne Group (Cockfield Formation)
92	14	Clay, brown, silty, carbonaceous.
137	45	Sand, brown, fine-grained, clayey, lignitic.
145	8	Clay, brownish-gray, sandy, lignitic.
158	13	Sand, brownish-gray, clayey, lignitic.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
180	22	Clay, brownish-gray, silty.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
198	18	Marl, grayish-green, sandy, glauconitic, fossiliferous.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
220	22	Marl, very-light-gray to light-gray, clayey, fossiliferous.
232	12	Marl, very-light-gray to light-gray, silty to sandy, glauconitic, fossiliferous.
247	15	Marl, light-greenish-gray, clayey, glauconitic, fossiliferous.
256	9	Marl, grayish-green, silty, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
270	14	Clay, brown, silty, fossiliferous.
284	14	Sand, light-brown, fine-grained, clayey.
300	16	Sand, light-brown, fine- to medium-grained, clayey, carbonaceous.

AN-53

Location: Center W/L NW/4, NE/4, NE/4, Sec. 15, T.1 N., R.16 E.

Elevation: 325 feet (Topographic map) Date: April 26, 1977

Purpose: Drilled 270 feet for stratigraphic information. Electrical log from 0 to 269 feet.

Depth	Thickness	Description
		Jackson Group (Yazoo Formation—North Twistwood Creek Clay member)
5	5	Clay, yellow-gray, yellowish-orange, silty.
20	15	Clay, light-yellowish-gray.
32	12	Clay, light-yellowish-gray, fossiliferous.
54	22	Clay, grayish-green to light-green, fossiliferous.
		Jackson Group (Moodys Branch Formation)
60	6	Clay, light-greenish-gray, sandy, glauconitic, fossiliferous.
72	12	Marl, greenish-gray, sandy, glauconitic, fossiliferous.
		Claiborne Group (Cockfield Formation)
92	20	Clay, grayish-brown, sandy, carbonaceous.
120	28	Sand, brown, fine-grained, clayey, lignitic.
138	18	Clay, gray, silty, carbonaceous.
144	6	Clay, gray, silty, sandy, lignitic.
158	14	Clay, grayish-brown, silty, carbonaceous.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
178	20	Clay, grayish-brown to brownish-green, silty.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
198	20	Marl, grayish-green, clayey, silty, glauconitic, fossiliferous.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
240	42	Clay, light-greenish-gray, marly, glauconitic, fossiliferous.
256	16	Marl, grayish-green, clayey, silty, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
270	14	Clay, brown, silty.

AN-54

Location: Near center SW/4, NW/4, SE/4, Sec. 32, T.3 N., R.15 E. Approximately 100 feet south of King's Bluff on Chickasawhay River.

Elevation: 290 feet (Topographic map) Date: April 27, 1977

Purpose: Drilled 230 feet for stratigraphic information. Electrical log from 0 to 229 feet.

Depth	Thickness	Description
		Claiborne Group (Cockfield Formation)
14	14	Clay, reddish-brown to orangish-yellow, sandy, carbonaceous.
24	10	Clay, dark-brown, silty, shaly, carbonaceous.
32	8	Clay, brownish-gray to gray, silty, carbonaceous.
48	16	Clay, brownish-gray to gray, sandy, carbonaceous.
68	20	Sand, brownish-gray, fine-grained, clayey, carbonaceous to lignitic.

78	10	Clay, gray, silty.
91	13	Sand, gray, fine-grained, clayey, lignitic.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
114	23	Clay, brownish-gray, silty.
127	13	Clay, brownish-gray, shaly.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
134	7	Clay, greenish-gray to light-gray, silty, glauconitic, fossiliferous.
144	10	Clay, light-greenish-gray, silty, marly, glauconitic, fossiliferous.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
160	16	Marl, light-bluish-gray, silty, glauconitic, fossiliferous, indurated streaks.
170	10	Clay, gray, marly, glauconitic, fossiliferous.
200	30	Marl, light-gray to gray, silty, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
220	20	Clay, gray to dark-gray, silty carbonaceous.
230	10	Sand, brown, fine-grained, clayey, lignitic.

AN-55

Location: SW/4, NE/4, SW/4, Sec. 23, T.2 N., R.14 E.

Elevation: 295 feet (Topographic map) Date: April 27, 1977

Purpose: Drilled 210 feet for stratigraphic information. Electrical log from 0 to 209 feet.

Depth	Thickness	Description
		Claiborne Group (Cockfield Formation)
10	10	Clay, orangish-brown, silty, sandy, ferruginous.
32	22	Clay, brownish-gray, silty, sandy.
43	11	Clay, greenish-gray, silty, carbonaceous.
54	11	Clay, sand streaks, gray, carbonaceous.
102	48	Sand, gray, fine-grained, clay streaks, lignitic.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
112	10	Clay, brownish-gray.
121	9	Clay, greenish-gray to green, glauconitic.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
128	7	Clay, gray to grayish-green, marly, glauconitic, fossiliferous.
142	14	Clay, light-greenish-gray, marly, glauconitic, fossiliferous.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
180	38	Marl, light-gray, silty, glauconitic, fossiliferous.
195	15	Marl, greenish-gray, sandy, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
210	15	Sand, gray, medium-grained; clay streaks, carbonaceous.

AN-56

Location: SW/4, NE/4, NW/4, Sec. 21, T.2 N., R.14 E.

Elevation: 300 feet (Topographic map) Date: April 28, 1977

Purpose: Drilled 90 feet for stratigraphic information. Electrical log from 0 to 88 feet.

Depth	Thickness	Description
		Jackson Group (Moodys Branch Formation)
15	15	Clay, yellowish-gray to brownish-gray, sandy, glauconitic.
20	5	Clay, light-gray, sandy, glauconitic.
		Claiborne Group (Cockfield Formation)
44	24	Clay, brownish-gray, sandy, carbonaceous.
50	6	Clay, brown, sandy, carbonaceous.
63	13	Sand, gray to dark-gray, fine-grained, clayey, carbonaceous.
72	9	Clay, brownish-gray, sandy, carbonaceous.
86	14	Sand, greenish-gray, fine-grained, sandy.
90	4	Clay, brownish-gray to gray, silty, carbonaceous.

AN-57

Location: NW/4, SW/4, SW/4, Sec. 6, T.2 N., R.16 E. Behind welding shop.

Elevation: 250 feet (Topographic map) Date: April 28, 1977

Purpose: Drilled 100 feet for stratigraphic information. Electrical log from 1 foot to 98 feet.

Depth	Thickness	Description
		Claiborne Group (Cockfield Formation)
10	10	Sand, brownish-yellow, fine- to medium-grained, clayey.
28	18	Sand, brownish-yellow, medium- to coarse-grained, clayey.
		Claiborne Group (Cook Mountain Formation—Gordon Creek Shale member)
50	22	Clay, grayish-green, silty.
62	12	Clay, greenish-gray, silty.
68	6	Clay, greenish-gray, silty, glauconitic.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
89	21	Marl, gray to grayish-green, clayey, glauconitic, fossiliferous.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
100	11	Marl, light-greenish-gray, clayey, glauconitic, fossiliferous.

AN-58

Location: SW/4, NW/4, SW/4, SE/4, Sec. 14, T.2 N., R.15 E.

Elevation: 240 feet (Topographic map) Date: May 2, 1977

Purpose: Drilled 90 feet for stratigraphic information. Electrical log from 1 foot to 88 feet.

Depth	Thickness	Description
5	5	No samples or driller's log.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)

6.5	1.5	Marl, yellowish-gray, clayey, silty, glauconitic, fossiliferous.
19	12.5	Marl, light-gray, silty, clayey, fossiliferous.
22	3	Sand, yellowish-green to dark-green, fine-grained, glauconitic, fossiliferous.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
33	11	Marl, light-gray, silty, fossiliferous.
40	7	Marl, light-yellowish-gray, silty, glauconitic, fossiliferous.
45	5	Marl, light-gray, silty, fossiliferous.
58	13	Marl, greenish-gray, sandy, fossiliferous.
76	18	Marl, dark-greenish-gray, clayey, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
90	14	Clay, gray to grayish-brown, sandy.

AN-59

Location: NW/4, SE/4, NW/4, Sec. 6, T.4 N., R.17 E.

Elevation: 550 feet (Topographic map) Date: May 3, 1977

Purpose: Cored/drilled 200 feet for stratigraphic information. Electrical log from 0 to 200 feet.

Depth	Thickness	Description
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
4	4	Claystone, siltstone, grayish-yellow.
9	5	Clay, yellowish-gray, silty.
11	2	Claystone, grayish-yellow to brownish-yellow.
20	9	Sandstone, claystone, clay, greenish-gray to grayish-green, glauconitic.
36	16	Clay, claystone, greenish-gray, silty.
50	14	Claystone, greenish-gray to grayish-green, clay.
64	14	Clay, claystone, light-greenish-gray to grayish-green.
69	5	Sand, grayish-yellow, coarse-grained, clayey, glauconitic.
76	7	Clay, yellowish-gray, silty.
		Claiborne Group (Tallahatta Formation—Meridian Sand member)
80	4	Sand, light-gray, medium- to coarse-grained.
103	23	Sand, light-gray, fine- to medium-grained.
		Wilcox Group (Hatchetigbee Formation)
120	17	Sand, light-gray to grayish-yellow, fine- to coarse-grained, clayey.
130	10	Sand, light-gray, medium- to coarse-grained, clayey.
140	10	Sand, yellowish-gray, fine- to coarse-grained, clayey, ferruginous.
150	10	Sand, light-gray, fine-grained.
165	15	Sand, yellowish-gray, fine-grained, clayey, ferruginous.
174	9	Sand, light-yellow to light-gray, fine-grained, clayey.
180	6	Clay, gray, sandy, carbonaceous.
193	13	Clay, orangish-yellow, sandy.
200	7	Clay, gray, lignitic.

AN-60

Location: SW/4, SE/4, NW/4, Sec. 2, T.4 N., R.14 E. In sand pit.

Elevation: 290 feet (Topographic map) Date: May 4, 1977

Purpose: Cored/drilled 72 feet for stratigraphic information. Electrical log from 2 to 72 feet.

Depth	Thickness	Description

		Claiborne Group (Winona Formation)
12.5	12.5	Clay, reddish-brown to yellow to orangish-green, sandy, glauconitic, fossiliferous.
22	9.5	Clay, light-green to green to yellowish-green, sandy, glauconitic, fossiliferous.
24	2	Sand, dark-green, medium- to coarse- grained, glauconitic, fossiliferous.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
28	4	Sand, gray to yellow, very fine-grained.
43	15	Clay, dark-grayish-green to grayish-green, silty, claystone.
50	7	Clay, claystone, sandstone, dark-gray to dark-greenish-gray, glauconitic.
60	10	Clay, grayish-green, silty, claystone, glauconitic.
65	5	Clay, grayish-green to light-grayish-yellow, sandy.
72	7	Sandstone, light-grayish-yellow.

AN-61

Location: SW/4, SE/4, SW/4, SW/4, Sec. 28, T.1 N., R.14 E. On ridge top 200 feet west of paved road.

Elevation: 440 feet (Topographic map) Date: May 9, 1977

Purpose: Cored 72 feet for stratigraphic information. No electrical log.

Depth	Thickness	Description
		Citronelle Formation
8	8	Sand, reddish-brown, fine- to medium-grained, clayey, pea gravel.
		Vicksburg Group (Bucatunna Formation)
10	2	Clay, orangish-red, sandy.
16	6	Clay, grayish-yellow to orangish-yellow, sandy.
17	1	Clay, reddish-gray, mottled.
21	4	Clay, yellowish-gray.
22	1	Clay, yellowish-gray, ferruginous streaks.
34	12	Clay, gray.
35	1	Clay, gray, yellowish-brown streaks.
		Vicksburg Group (Glendon Formation)
42	7	Marl, limestone, grayish-yellow, fossiliferous.
52	10	Limestone, yellowish-gray to orangish-yellow.
		Vicksburg Group (Marianna Formation)
55	3	Limestone, yellowish-brown to reddish-brown, fossiliferous.
62	7	Limestone, light-gray to grayish-yellow, clay streaks, fossiliferous.
		Vicksburg Group (Mint Spring Formation)
64	2	Clay, light-yellowish-gray, marly, fossiliferous, indurated streaks.
66	2	Limestone, white to light-gray, clayey, fossiliferous.
69	3	Clay, yellowish-gray, marly, silty, fossiliferous, indurated streaks.
71.5	2.5	Marl, light-gray, sandy, glauconitic, fossiliferous.
		Red Bluff Formation
72	0.5	Clay, light-green, fossiliferous.

AN-62

Location: SW/4, SE/4, NE/4, Sec. 10, T.10 N., R.8 W.

Elevation: 315 feet (Topographic map) Date: May 10, 1977

Purpose: Drilled 100 feet for stratigraphic information. Electrical log from 0 to 72 feet.

Depth	Thickness	Description
		Vicksburg Group (Mint Spring—Marianna Formation(s) undifferentiated)
10	10	Sand, reddish-brown, clayey.
14	4	Sand, brownish-yellow, clayey.
17	3	Clay, grayish-yellow, bentonitic.
22	5	Clay, brownish-yellow to grayish-yellow, marly, fossiliferous.
		Red Bluff Formation
41	19	Clay, gray, silty, fossiliferous.
49	8	Clay, gray, silty, carbonaceous.
87	38	Clay, greenish-gray, silty, fossiliferous.
100	13	Clay, gray, silty, carbonaceous, fossiliferous.

AN-63

Location: Near center E/2, NW/4, Sec. 18, T.2 N., R.16 E. Dobys Bluff on Chickasawhay River.

Elevation: 280 feet (Topographic map) Date: May 10, 1977

Purpose: Drilled 110 feet for stratigraphic information. Cored 30 to 84.5 feet. Electrical log from 2 to 109 feet.

Depth	Thickness	Description
		Terrace Deposit
10	10	Clay, orangish-yellow to brownish-yellow, silty.
17	7	Clay, pinkish-gray to yellowish-gray, silty.
22	5	Sand, white, coarse-grained, pea gravel.
		Claiborne Group (Cook Mountain Formation—Potterchitto and Archusa Marl members, undifferentiated)
25	3	Clay, greenish-yellow, marly, glauconitic, fossiliferous.
39	14	Marl, bluish-gray, silty, glauconitic, fossiliferous, partially indurated.
44	5	Marl, light-greenish-gray, clayey, silty, partially indurated.
54	10	Marl, dark-greenish-gray, clayey, glauconitic, fossiliferous.
56	2	Marl, greenish-gray, silty, glauconitic, fossiliferous.
66	10	Marl, greenish-gray, sandy, glauconitic, fossiliferous, limestone streaks.
74	8	Marl, greenish-gray, silty, glauconitic, fossiliferous, partially indurated.
83	9	Marl, greenish-gray, silty, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
90	7	Clay, brownish-gray, silty, fossiliferous.
97	7	Clay, brownish-gray, glauconitic, fossiliferous, sand streaks.
100	3	Clay, greenish-gray, silty, fossiliferous.
110	10	Sand, brown, fine-grained, clayey, lignitic.

AN-64

Location: SE/4, NE/4, SE/4, Sec. 22, T.3 N., R.15 E.

Elevation: 280 feet (Topographic map) Date: April 17, 1978

Purpose: Drilled 160 feet for stratigraphic information. Electrical log from 0 to 159 feet.

Depth	Thickness	Description

Depth	Thickness	Description
		Claiborne Group (Kosciusko Formation)
6	6	Clay, brownish-red to yellowish-red, sandy.
20	14	Clay, light-gray to yellowish-gray, silty.
40	20	Clay, bluish-gray, carbonaceous.
50	10	Clay, bluish-gray, silty, lignitic.
70	20	Sand, brownish-gray to bluish-gray, fine-grained, clay streaks, lignitic.
78	8	Sand, brownish-gray, medium- to coarse-grained, lignitic.
82	4	Sand, brownish-gray, fine- to medium-grained.
87	5	Clay, brownish-gray, sandy, lignitic.
92	5	Sand, brownish-gray, medium-grained, clayey.
100	8	Clay, brownish-black, sandy, lignitic.
113	13	Sand, brownish-black, fine- to medium-grained, clayey, lignitic.
		Claiborne Group (Zilpha Formation)
132	19	Clay, dark-greenish-gray, silty, partially indurated.
140	8	Clay, brownish-gray, silty, carbonaceous.
148	8	Clay, greenish-gray, silty.
		Claiborne Group (Winona Formation)
156	8	Sand, sandstone, green to grayish-green, glauconitic, fossiliferous.
159	3	Sand, greenish-gray to gray, fine-grained, clayey.
160	1	Sandstone, greenish-gray, glauconitic, fossiliferous.

AN-65

Location: Near center N/2, NW/4, SE/4, Sec. 27, T.3 N., R.15 E.

Elevation: 225 feet (Topographic map) Date: April 18, 1978

Purpose: Drilled 302 feet for stratigraphic information. Electrical log from 0 to 301 feet.

Depth	Thickness	Description
		Alluvium
10	10	Clay, yellowish-brown to grayish-yellow, sandy.
14	4	Sand, yellowish-gray, fine-grained, clayey.
		Claiborne Group (Cook Mountain Formation—Potterchitto member)
23	9	Clay, bluish-gray, silty, glauconitic.
33	10	Marl, greenish-gray, sandy, glauconitic, fossiliferous.
		Claiborne Group (Cook Mountain Formation—Archusa Marl member)
54	21	Marl, bluish-gray, clayey, glauconitic, fossiliferous, indurated streaks.
60	6	Clay, bluish-gray, marly, glauconitic, fossiliferous.
78	18	Marl, light-gray to gray, silty, glauconitic, fossiliferous.
90	12	Marl, bluish-gray to gray, silty, glauconitic, fossiliferous.
		Claiborne Group (Kosciusko Formation)
98	8	Clay, light-brownish-gray.
108	10	Clay, brownish-gray, sandy, fossiliferous.
113	5	Clay, brownish-gray, sandy, lignitic.
120	7	Sand, brownish-gray to brown, fine-grained, clayey, lignitic.
145	25	Sand, brownish-gray, medium- to coarse-grained, clayey, lignitic.
147	2	Clay, brownish-black, lignitic.
170	23	Sand, brownish-gray, fine- to medium-grained, clayey, lignitic.
200	30	Sand, gray to brownish-gray, fine-grained, clayey, lignitic.
228	28	Sand, gray, fine-grained, clayey, lignitic.
232	4	Clay, gray, lignitic.
241	9	Sand, light-gray, fine- to medium-grained, clayey.

248	7	Sand, brownish-gray, medium- to coarse-grained, clayey, lignitic.
		Claiborne Group (Zilpha Formation)
260	12	Clay, brownish-gray carbonaceous.
280	20	Clay, greenish-gray to brownish-gray, silty.
292	12	Clay, brownish-gray.
		Claiborne Group (Winona Formation)
302	10	Sand, sandstone, greenish-gray, glauconitic, fossiliferous.

AN-66

Location: SW/4, SW/4, SW/4, Sec. 22, T.3 N., R.15 E.

Elevation: 260 feet (Topographic map) Date: April 19, 1978

Purpose: Drilled 200 feet for stratigraphic information. Electrical log from 0 to 199 feet.

Depth	Thickness	Description
		Claiborne Group (Kosciusko Formation)
10	10	Sand, orangish-red to yellowish-gray, fine-to medium-grained, clayey.
20	10	Sand, yellowish-gray, fine- to coarse-grained.
33	13	Sand, light-gray, medium-grained.
43	10	Clay, yellowish-gray to gray, silty.
48	5	Silt, yellowish-gray to light-gray, clay streaks.
75	27	Sand, yellowish-gray to light-gray, fine-grained, clayey.
82	7	Silt, brownish-black, sandy, lignitic.
98	16	Clay, gray to brownish-black, sandy, lignitic.
112	14	Sand, gray to brownish-black, medium- to coarse-grained, clayey, lignitic.
		Claiborne Group (Zilpha Formation)
117	5	Clay, dark-greenish-gray, sandy, carbonaceous.
126	9	Clay, brownish-gray to greenish-gray, silty.
139	13	Clay, greenish-gray, silty, glauconitic.
		Claiborne Group (Winona Formation)
155	16	Sand, greenish-gray, very fine-grained, clayey, glauconitic, fossiliferous, indurated streaks.
165	10	Sandstone, sand, grayish-green, very fine-grained, clayey, glauconitic, fossiliferous.
		Claiborne Group (Tallahatta Formation—Basic City Shale member)
200	35	Clay, claystone, bluish-gray, glauconitic.

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WATER RESOURCES OF CLARKE COUNTY, MISSISSIPPI

by

Danny W. Harrelson

ABSTRACT

Ground water is available in Clarke County in sufficient quantities for present rural, municipal, public, or industrial demand. Potable ground water is present in thirteen aquifers from Eocene through Holocene ages. Wells completed in these aquifers vary in depth from 69 feet in northern Clarke County to 2386 feet in southern Clarke County. Quality problems of the ground water produced from these aquifers include excess color, a pH below 7.0, total dissolved solids above 500 milligrams per liter (mg/l), and iron concentrations in excess of 0.3 mg/l. Transmissibilities for the aquifers in Clarke County vary from 4000 to 172,000 gallons per day per foot (gpd/ft) and yields can exceed 500 gallons per minute (gpm). Hydrostatic head within the major aquifers is sufficient to cause many wells to flow or have a static water level which rises to within a few feet of the land surface.

The Wilcox aquifers are the only relatively undeveloped aquifers in Clarke County. These aquifers have the best potential of any ground-water or surface-water source in Clarke County due to excellent static water levels, good chemical quality, and high yields. The Wilcox aquifers could adequately support additional municipal, public, rural, or industrial development within the county, and should prove to be a valuable ground-water source into the next century.

Surface water is available in large quantities from the Chickasawhay River and Bucatunna and Souinlovey Creeks. These surface-water sources are limited by low flow, so impoundment must be considered to increase surface-water supplies. The surface-water quality is good, and can be used for most purposes with only a minimum of treatment. Brine pollution of surface-water sources is restricted, and should pose few future contamination problems provided leaking salt-water evaporation pits are eliminated.

GROUND WATER

Introduction

All of Clarke County is underlain by at least two fresh-water aquifers. Water wells constructed in these fresh-water aquifers are from less than 30 feet in depth in the northeast of Clarke County to more than 2300 feet in depth in the southern part of the county.

Precipitation on the outcrop areas of the various aquifers is the only source of ground-water recharge in the county. Callahan (1975) states the total ground-water withdrawal from all municipal, public, industrial, and rural self-supplied sources in Clarke County is 1.472 million gallons per day. Ground-water withdrawal is exceeding recharge in the county, so the static water level (S.W.L.) of most water wells is declining at an average rate of 0.3 foot per year.

Potable ground water is available in large quantities from sand intervals within the Wilcox Group, Meridian Sand, Kosciusko (Sparta) Formation, and Cockfield Formation. These four major aquifers, though not developed to their fullest potential, supply the county with 95% of its ground water. The Cockfield and Kosciusko Formations and the Meridian Sand produce water of inferior quality with respect to the deeper Wilcox Group, and thus may never be developed to maximum potential. The Wilcox aquifers produce the best quality water analyzed in the county. Superior permeability, transmissibility, and quality indicate the Wilcox sands have the capacity to handle adequately future large capacity industrial, municipal, or public water supplies.

Minor aquifers having sands capable of yielding small to moderate amounts of ground water include the Tallahatta Formation, Winona Formation, Cocoa Sand, and the Red Bluff, Mint Spring and Catahoula Formations. These six formations supply only 4% of the total amount of ground water used in the county. A few small rural self-supplied wells are completed in the Winona and Tallahatta Formations in west-central Clarke County and the Red Bluff and Catahoula Formations in southwestern Clarke County. These minor aquifers should produce enough ground water for rural self-supplied uses, but will have limited potential due to low transmissibility and erratic sand developments.

The Pleistocene Series in Clarke County contains sands that

can yield a small amount of poor quality water. Water produced from the Pleistocene aquifers is extremely variable in quality, but most is hard, acidic, and contains iron concentrations in excess of 0.3 mg/l. Water table conditions exist within the Pleistocene aquifers, and static water levels will fluctuate seasonally. Because of poor sorting, poor water quality, and restricted occurrence the Pleistocene Series has extremely limited potential as a ground-water source in Clarke County.

The Holocene Series in the flood plains of streams in Clarke County contains erratic sand development. The Holocene aquifers are not continuous enough to serve as a source of ground water. Water in the Holocene aquifers is under water-table conditions, so static water levels vary with streamflow and precipitation. Few wells are completed in the Holocene aquifers because of poor water quality, erratic sand development, and fluctuating static water levels.

Because of restricted occurrence and very limited potential, neither the Pleistocene nor the Holocene aquifers will be developed as a major ground-water source in Clarke County. Only a trace of the total ground water produced in Clarke County is from Pleistocene or Holocene aquifers. Ground water produced from these two aquifers is restricted to uses in which good quality or large quantity is not a major concern.

Methods of Investigation

Contained in this report is information on the availability and quality of the ground water from each aquifer in Clarke County (Fig. 1). The data summarized in this report will supplement information on the water resources of Clarke County previously published by Boswell (1970), Callahan (1971, 1975), Shows (1970), Stephenson (1928), and the U. S. Geological Survey Water Resources Division (1968, 1970, 1971, 1972).

One hundred seventy wells were located "in the field" in Clarke County (Fig. 2) to verify correct owner, elevation, screened interval, screen length, casing diameter, static water level, method of lift, water-bearing unit, yield, and use. These accumulated data are summarized under the "Records of Selected Wells" (Table 1), and should assist in the planning of industrial, municipal, public, or rural self-supplied sources.

A Hach colorimeter was used to determine the chemical

FIGURE 1 — STRATIGRAPHIC COLUMN AND WATER RESOURCES DATA OF CLARKE COUNTY, MISSISSIPPI

SYSTEM	SERIES	GROUP	STRATIGRAPHIC UNIT	WATER RESOURCES DATA	THICKNESS (feet)
QUATERNARY	HOLOCENE		Alluvium	Not an important aquifer. Occurrence restricted to flood plains of streams. Can supply small amount of very poor quality water to shallow wells.	0 to 44
	PLEISTOCENE		Terrace deposits	Generally not an aquifer. Can supply small amounts of poor quality water to shallow wells.	0 to 44
			Citronelle Formation	Not an important aquifer due to restricted occurrence. May yield small quantities of poor quality water to shallow wells in extreme Southwestern Clarke County.	0 to 120
TERTIARY	MIOCENE		Catahoula Formation	Limited aquifer due to restricted occurrence. Can yield up to 15 gpm of acid water to shallow wells in Southwestern Clarke County.	0 to 76
	OLIGOCENE	VICKSBURG	Bucatunna Formation	NOT AN AQUIFER	0 to 20
			Byram Formation	NOT AN AQUIFER	0 to 14
			Glendon Formation	NOT AN AQUIFER	0 to 18
			Marianna Formation	NOT AN AQUIFER	14 to 24
			Mint Spring Formation	Very limited aquifer. Water quality is good to excellent. May supply small amounts of water to rural self-supplied wells downdip of outcrop area.	6 to 15
			Red Bluff Formation	Limited aquifer due to restricted occurrence. Water may have iron concentrations above .3 mg/l. Yields will be small, generally not above 8 gpm	100 to 125
	EOCENE	JACKSON	Yazoo Formation — Shubuta Clay	NOT AN AQUIFER	36 to 128
			Yazoo Formation — Pachuta Marl	NOT AN AQUIFER	10 to 25
			Yazoo Formation — Cocoa Sand	Generally not an aquifer. Can supply small yield rural self-supplied wells up to 5 gpm of water in Southeastern Clarke County.	0 to 20
			Yazoo Formation — North Twistwood Creek Clay	NOT AN AQUIFER	50 to 70
			Moodys Branch Formation	NOT AN AQUIFER	0 to 25
		CLAIBORNE	Cockfield Formation	Major aquifer in southern third of Clark County. Excellent source for shallow, small yield, rural self-supplied wells. Water can be colored and may contain iron concentrations in excess of .3 mg/l.	0 to 112
			Cook Mountain — UNDIFFERENTIATED	NOT AN AQUIFER	0 to 150
			Kosciusko Formation	Most utilized aquifer in Clarke County. Very important water source in southern half of Clarke County. Water may be colored and total dissolved solids increase downdip of outcrop area.	0 to 170
			Zilpha Formation	NOT AN AQUIFER	0 to 100
			Winona Formation	Generally not an aquifer. Can yield small amounts of poor quality water to shallow wells in Northeastern Clarke County.	0 to 35
			Tallahatta Formation — UNDIFFERENTIATED	Not an aquifer. The formation may contain enough sand development to yield small amounts of very poor quality water. Water has total dissolved solids above 1,000 mg/l.	0 to 200
			Tallahatta Formation — Meridian Sand	Major aquifer. Can yield up to 200 gpm to properly constructed water wells. Excess color and high iron concentrations are major quality problems in Meridian water produced in Southwestern Clarke County.	0 to 90
		WILCOX	UNDIFFERENTIATED	Most important aquifer in Clarke County, but the aquifer is not developed to maximum potential. Many wilcox wells in central and southern Clarke County flow. Water quality is excellent, but total dissolved solids tend to increase downdip from the outcrop area. This aquifer underlies all of Clarke County, and can yield 500 gpm or more of good quality water.	0 to 400

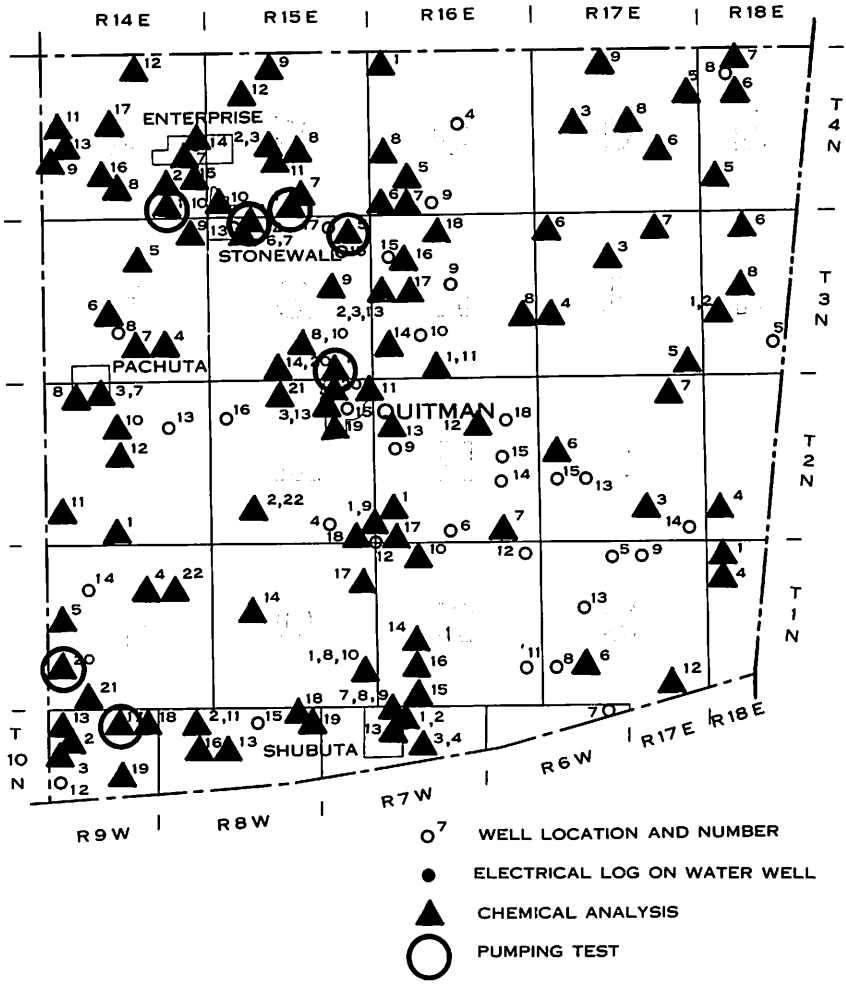

Figure 2.— Location of electrical logs in Clarke County.

quality of the ground water in Clarke County. One hundred water samples from the county's thirteen aquifers were collected "in the field" and analyzed for silica, iron, calcium, magnesium, sodium, potassium, sulfate, chloride, fluoride, total dissolved solids, specific conductance, pH, temperature, hardness, and color. Complete laboratory analyses of some ground-water samples conducted by the Mississippi State Board of Health and the United States Geological Survey are summarized along with the field analyses under the "Records of Selected Chemical Analyses" (Table 2).

TABLE 1

RECORDS OF SELECTED WELLS IN CLARKE COUNTY

Well No.: Numbers correspond to those on well-location maps, chemical-analysis tables and pumping test tables.

Majority of wells are rotary drilled.

Water Level: M, Measured; R, Reported; O, Observed; Est., Estimated.

Method of Lift: A, Air Lift; C, Cylinder; F, Natural Flow; J, Jet; N, None; P, Pitcher; T, Turbine; S, Submersible; B, Bucket.

Elevation: Elevations determined mostly from topographic maps having contour intervals of 10 or 20 feet.

Use of Well: D, Domestic; I, Industrial; IR, Irrigation; N, None; O, Observation; P, Public Supply; S, Stock; T, Test; A, Abandoned; U, Unused.

Remarks: C, Chemical Analysis; O, Observation Well; P, Pumping Test; E, Electric Log; X, Open Ended Well.

Well No.	Owner	Year Drilled	Altitude of land surface datum (feet)	Depth (feet)		Casing diameter (inches)	Water level		Method of lift	Water bearing unit	Use	Yield		Remarks
				Well	Top of screen		Above (+) or below LSD (feet)	Date of measurement				Gallons per min.	Date	
A1	Southern Natl. Gas Co. Well #2	1967	260	1355	1315	10	+30 (R)	1967	T	WLCX.	I	380	1967	C, E, P
A2	Helms Hereford Farm	1973	250	1336	1273	4, 2	+30 (R)	1973	N,F	WLCX.	S	50	1973	C, E
A7	Town of Enterprise	1964	260	250	220	10	16 (R)	1965	T	MUWX.	P	155	1965	C, E
A8	George Cotton	1963	340	335	324	3 7/8	70 (R)	1963	J	MUWX.	D			C
A9	Dennis Buckley	1971	378	151	147	2	93 (R)	1971	J	KOSC.	D	8	1971	C
A10	Southern Natl. Gas Well #1	1951	267	1242	1192	10	+19 (R)	1951	T	WLCX.	I	300	1951	C, E, P
A11	Roosevelt McGruder	1963	380	120	114	2	65 (R)	1963	J	KOSC.	D			C
A12	Thilbut Little	1962	345	252	147	3	80 (R)	1962	J	MUWX.	D			C, X
A13	Mattie Jones	1965	340	132	126	2	60 (R)	1965	J	KOSC.	D			C
A14	Pitcher Pump @ Bass Bros. Store		243			3			P	ALLUV.	N	3.5		C
A15	Flowing Well Sec. 25		241			2	+ (O)	1978	N,F	KOSC.	S	.25	1978	C
A16	Magnolia Meth. Church	1974	353	451	241	4	96 (R)	1974	S	MUWX.	D	10	1974	C, X
A17	George Williams	1971	350	99	95	2 5/8	56 (R)	1971	J	KOSC.	D	6	1971	C

RECORDS OF SELECTED WELLS IN CLARKE COUNTY

Well No.	Owner	Year Drilled	Altitude of land surface datum (feet)	Depth (feet) Well	Depth (feet) Top of screen	Casing diameter (inches)	Water level Above (+) or below LSD (feet)	Water level Date of measurement	Method of lift	Water bearing unit	Use	Yield Gallons per min.	Yield Date	Remarks
B1	Harmony Wtr. Assn. Sandy Basin #1	1972	360	378	337	8 5/8	106 (R)	1972	T	MUWX.	P	200	1972	C, E, P
B2	Harmony Wtr. Assn. Ext. #3	1975	440	1359							T			E
B3	Harmony Wtr. Assn. Ext. #3	1975	445	1381	1341	8 5/8	135 (R)	1975	T	WLCX	P			E
B7	Ray Smith	1968		340	315	4	50 (R)	1968	J	MUWX	D	6	1968	C
B8	Paul Rollison	1968	360	69	63	2	33 (R)	1968	J	KOSC.	D	15	1968	C
B9	Flowing Well Sec. 4		239			3	+ (O)	1978	N,F	KOSC.	S	2.5	1978	C
B10	James Taylor	1964	240	148	143	3 7/8	26 (R)	1964	J	TLLT.	D			
B11	J. D. Cross	1971	400	115	52	4	20 (R)	1971	J	KOSC.	D	10	1971	X
B12	Flowing Well Sec. 8		240			3	+ (O)	1978	N,F	KOSC.	U	3	1978	C
C1	Clarkdale Wtr. Assn. Well #3	1965	539	1270	1220	10. 6	247 (R)	1967	T	WLCX.	P	164	1967	C, E
C4	Donald M. Caraway	1968	460	317	312	2	160 (R)	1968	J	MRDN.	A	3	1968	
C5	Frank Riley	1963	450	290	96	4	110 (R)	1963	C	MRDN.	IR.	4	1978	C, X
C6	Bobby Martin	1972	379	63	58	2	46 (R)	1972	J	KOSC.	D	10	1972	C
C7	J. L. Dearman	1970	465	260	176	4	90 (R)	1970	S	MUWX.	D	10	1970	C, X
C8	Paul Callahan	1972	420	87	82	2	60 (R)	1972	J	KOSC.	D	3	1972	C
C9	Morris Griffin	1964	460	110	105	2	75 (R)	1964	J	KOSC.	IR.			
D3	New Bethel Bapt. Church	1973	405	520	240	4	124 (R)	1973	S	MRDN.	D	10	1973	C, X
D4	Jackie Irby	1966	432	225	220	3 7/8-2	168 (R)	1966	J	WLCX.	D			
D5	Richard Cooper	1972	454	470	400	4	193 (R)	1972	S	WLCX.	D	10	1972	C, X
D6	Leland Goodman	1970	365	395	101	4	105 (R)	1970	J	WLCX.	D	9	1970	C, X
D8	Spring in Sec. 15		363				+ (O)	1978	N,F	MRDN.	N	10	1978	C
D9	Earl Martin	1961	445	514	282	4	163 (R)	1961	C	WLCX.	D			C, X

RECORDS OF SELECTED WELLS IN CLARKE COUNTY

Well No.	Owner	Year Drilled	Altitude of land surface datum (feet)	Depth (feet) Well	Depth (feet) Top of screen	Casing diameter (inches)	Water level Above (+) or below LSD (feet)	Water level Date of measurement	Method of lift	Water bearing unit	Use	Yield Gallons per min.	Yield Date	Remarks
E5	J. R. Davidson	1974	448	440	216	4	150 (R)	1974	S	WLCX.	D	6	1974	C, X
E6	W. L. Cooper	1967	400	470	175	4	210 (R)	1972	J	WLCX.	D	10	1972	C, X
E7	J. D. Shirley	1966	440	430	262	4	160 (R)	1966	J	WLCX.	D	30	1966	C, X
E8	Lyle Shirley	1972	440	440	209	4	200 (R)	1972	S	WLCX.	D	10	1972	X
F4	Ronnie Sisson	1977	302	250		4			J	KOSC.	D			C, E
F5	Ernest Overby	1971	353	546	231	4	133 (R)	1977	S	MUWX.	D	15	1973	C, X
F6	Lee Nix	1973	306	180	170	4	40 (R)	1973	J	KOSC.	D	10	1973	
F7	Souinlovey Church	1964	355	196	191	2	110 (R)	1964	J	KOSC.	D	6		C
F8	Terry Beckman	1967	300	220	215	4	20 (R)	1967	J	KOSC.	D	6	1967	C
F9	Marion Pittman	1964	221	126	63	4	6 (R)	1967	C	KOSC.	D	6	1964	C, X
G1	City of Quitman #2	1976	302	1869	1762	12,8	10(R)	1976	T	WLCX.	P	475	1976	C, E, P
G2	Town of Stonewall	1976	341	1597	1507	12 3/4	53(R)	1976	T	WLCX.	P	750	1976	C, E, P
G5	Harmony Wtr. Assn. Sandy Basin T. H. #1	1969	322	310	304	2	88(R)	1969	S	MRDN.	U	35	1969	C, E, P
G6	Erwin Mills	1954	242	411	379	10	16(R)	1966	T	MUWX.	I	185	1954	C
G7	Erwin Mills	1966	242	424	375	10	16(R)	1966	T	MUWX.	I	269	1966	
G8	Amer. Cresote Works, Inc.	1964	231	273	252	2	+2.5(R)	1966	J	KOSC.	I			C
G9	Flowing Well Sec. 14		239				+(0)	1978	N,F	KOSC.	N	3	1978	C
G10	American Creosote Wks., Inc.	1964	230	252	246	2	+2(R)	1965	N,F	KOSC.	I			
G13	Town of Stonewall	1968	240	410	376	12			T	MUWX.	P	292	1968	C
G14	Masonite Corp.	1972	221	260	240	4	5(R)	1972	A	CCKF.	I	55	1972	C
G15	Harmony Wtr. Assn.	1972	300							KOSC.	T			E
G17	Price Buckalew	1974	302	282		4	39(R)	1974		MRDN.	D	14	1974	
G20	Masonite Corp.	1972	221	260?		4			A	CCKF.	I			

RECORDS OF SELECTED WELLS IN CLARKE COUNTY

Well No.	Owner	Year Drilled	Altitude of land surface datum (feet)	Depth (feet) Well	Depth (feet) Top of screen	Casing diameter (inches)	Water level Above (+) or below LSD (feet)	Water level Date of measurement	Method of lift	Water bearing unit	Use	Yield Gallons per min.	Yield Date	Remarks
H1	East Quitman Wtr. Assn. T.H.#1	1968	361	716		4					T			E
H2	Clarko State Park	1975	276	335	300	6,4	6 (R)	1975	S	MUWX.	A	60	1975	C, E
H3	Clarko State Park	1975	282	335	300	6,4	6 (R)	1975	S	MUWX.	P	60	1975	C, E
H8	Cleo Hayes	1963	310	220	175	4	27 (R)	1963	C	MUWX.	D			C, X
H9	Montrose Church	1968	370	360	170	4	80 (R)	1968		MUWX.	A	10	1968	X
H10	H. G. Holcroft	1971	320	300	276	4	25 (R)	1971		KOSC.	D	10		
H11	East Quitman Wtr. Assoc.	1968	340	320	280	10	125 (R)	1968	T	KOSC.	P	230	1968	C, E
H13	Clarko State Park	1938	270	384		6	+ 22 (R)	1961	T	MRDN.	A			C
H14	Paul Kufie	1962	270	173	168	2	34 (R)	1962	J	MRDN.	D			C
H15	D. H. Thompson	1971	320	300	195	4	80 (R)	1971	S	MRDN.	D	10	1971	
H16	W. L. James, Jr.	1963	400	310	155	4	96 (R)	1963	C	MUWX.	D			X
H17	Floyd McCarra	1968	300	279	273	4	134 (R)	1968	J	KOSC.	D	12	1968	
H18	George Mathis	1969	460	99	93	2	68 (R)	1969	J	KOSC.	D			
J3	Donald Campbell	1970	465	435	309	4	170 (R)	1970	S	MUWX.	D	10	1970	C, X
J4	Flowing Well Sec. 19		300				+ (O)	1978	N,F	KOSC.	S	4	1978	C
J5	W. McKennie, Jr.	1972	400	390	380	4	120 (R)	1972	S	MRDN.	D	10	1972	C
J6	E. P. Hearn	1973	360	151	146	2	111 (R)	1973	J	MUWX.	D	10	1973	C
J7	Leon Boutwell	1970	380	89	84	2	53 (R)	1970	J	KOSC.	D	6	1970	C
K1	East Quitman Wtr. Assn. #2	1975	498	1393	1323	12 3/4	246 (R)	1975	S	WLCX.	P	200	1975	C, E
K2	East Quitman Wtr. Assn. #3	1975	462	1349	1309	12 3/4 - 8	202 (R)	1975	S	WLCX.	P	250	1975	C, E
K5	Antioch Church	1970	402	400	336	4	160 (R)	1970	S	MUWX.	U	10	1970	X
K6	Cleo Long	1973	545	472	158	4	236 (R)	1973	S	WLCX.	D	10	1973	C, X
K8	J. R. Fleming	1966	531	258	252	2	179 (R)	1966	C	MUWX.	D			C

RECORDS OF SELECTED WELLS IN CLARKE COUNTY

Well No.	Owner	Year Drilled	Altitude of land surface datum (feet)	Depth (feet) Well	Depth (feet) Top of screen	Casing diameter (inches)	Water level Above (+) or below LSD (feet)	Water level Date of measurement	Method of lift	Water bearing unit	Use	Yield Gallons per min.	Yield Date	Remarks
L1	Barnett Wtr. Assn.	1968	310	330	310	4	80 (R)	1968	S	KOSC.	P	40	1968	E, C
L3	Town of Pachuta	1969	300	843	796	4	34 (R)	1969	S	MUWX.	T	55	1969	E, C
L7	Town of Pachuta	1969	260	460	400	10	60 (R)	1969	T	KOSC.	P	200	1969	E, C
L8	Town of Pachuta	1960	320	370	340	6	14 (R)	1966	T	KOSC.	P	150	1966	C
L10	J. W. Smith	1962	265	138	132	2	20 (R)	1962	J	CCKF.	D			C
L11	John The Bapt. Church	1968	330	192	180	2	57 (R)	1968	J	CCKF.	U			C
L12	Pearl Bester	1970	260	90	85	2	8 (R)	1970	J	CCKF.	D	10	1970	C
L13	C. F. Combest	1970	263	120	115	2	38 (R)	1970	J	CCKF.	D	10	1970	
M1	Desoto Wtr. Assn. T.H. #1	1967	230	169	149	4	+1(R)	1967	A	KOSC.	T	42	1967	C, E
M2	Harmony Wtr. Assn. #2	1972	310	306	244	10 3/4	112 (R)	1972	T	KOSC.	P	200	1972	C
M3	City of Quitman Ind. PK Well	1976	227	1934	1830	12, 8	61 (R)	1976	T	WLCX.	P	709	1976	C,E
M4	Desoto Wtr. Assn.	1967	299	245	186	10, 8	99 (R)	1967	S	KOSC.	P	200	1967	C
M9	Harmony Wtr. Assn.	1967	295	230	200	10	98 (R)	1967	T	KOSC.	P	112	1967	C
M11	City of Quitman	1965	230	289	247	10	15 (R)	1965	T	KOSC.	P	608	1965	C
M12	Desoto Meth. Church	1968	221	158	152	2	15 (R)	1962	J	KOSC.	D			
M13	City of Quitman	1920	230	204		6	11 (R)	1947	T	KOSC.	A	300	1947	C
M15	Bank of Quitman	1972	230	212	182	4	4 (R)	1972	S	KOSC.	D	50	1972	
M16	Lydia May	1972	300	279	168	4	82 (R)	1972	S	TLLT	D	15	1972	X
M17	Jerry Lewis	1970	260	217	212	2	80 (R)	1970	J	KOSC.	D	10	1970	
M18	Flowing Well Sec. 36		208			2 1 1/4	+ (0)	1978	N,F	CCKF.	N	1	1978	C
M19	Archusa Spring		221				+ (0)	1978	N,F	CCKF.	U	10	1978	C
M20	Flowing Well Sec. 2		203			1 1/2	+ (0)	1978	N,F	CCKF.	N	2	1978	C
M21	Flowing Well Sec. 4		200			2	+ (0)	1978	N,F	CCKF.	S	2	1978	C
M22	Harmony Wtr. Assn.	1966	300	275	228	10	47 (R)	1966	T	KOSC.	P		1966	C

RECORDS OF SELECTED WELLS IN CLARKE COUNTY

Well No.	Owner	Year Drilled	Altitude of land surface datum (feet)	Depth (feet) Well	Depth (feet) Top of screen	Casing diameter (inches)	Water level Above (+) or below LSD (feet)	Water level Date of measurement	Method of lift	Water bearing unit	Use	Yield Gallons per min.	Yield Date	Remarks
N1	Covington-Donald Unit #1	1969	245	1268		10,8			A	WLCX.	I			X
N6	Spring Hill Church	1969	295	180	174	2	100 (R)	1960		KOSC.	A			
N7	Miss. Forest Comm.	1961	365	347	337	2	155 (R)	1961	C	KOSC.	U			
N9	David Combest	1970	310	160	155	2	109 (R)	1970	J	KOSC.	D	10	1970	
N12	Amerada Hess Co.	1974	340	318	278	8	83 (R)	1974	T	KOSC.	I	120	1974	C
N13	Shiloh Bapt. Church	1969	323	195	189	2	143 (R)	1969	J	KOSC.	D	5	1969	C
N14	W. J. Dearman	1962	340	90	84	2	60 (R)	1962	C	CCKF.	D			
N15	Corinth Church	1963	359	218	213	2	110 (R)	1963	C	KOSC.	U			
N17	Flowing Well Sec. 31		195				+ (O)	1978	N,F	KOSC.	N	2.5	1978	C
N18	Hebron Ridge Church	1962	360	279	273	2	110 (R)	1962	C	KOSC.	D			
03	J. T. Reavis	1963	331	325	219	4	100 (R)	1963	C	KOSC.	D			C, X
04	Bill Anderson	1964	310	400	380	4	140 (R)	1964	S	MUWX.	D			C
06	Jeff Denham	1970	305	340	147	4	96 (R)	1970	S	TLLT.	D	10	1970	C, X
07	Roy Hayes	1969	300	236	231	4	105 (R)	1969	J	MRDN.	D	10	1969	C
013	Bernice Fleming	1969	320	290	189	4			J	MRDN.	A			X
014	Conway Drlg. Co.	1961	248	172	166	2	37 (R)	1961	A	KOSC.	I			
015	D. Fairdoth	1970	310	273	296	4	83 (R)	1970	J	KOSC.	D			
P2	Beaverdam Wtr. Assn.	1968	470	600	590	4,2	230 (R)	1968	S	CCKF.	P	35	1968	E
P3	Beaverdam Wtr. Assn.	1970	465	624	594	4	208 (R)	1970	S	CCKF.	P	30	1970	C, E
P4	Howard Mosley	1973	270	140	135	2	26 (R)	1973	J	KOSC.	D	10	1973	C
P5	Willie E. McCarty	1973	445	474	468	4,2 5/8	182 (R)	1973	J	KOSC.	D	7	1973	C
P12	Earl More	1969	360	597	577	2	110 (R)	1969	J	CCKF.	D	6	1969	
P13	J. F. Merril	1969	480	110	105	2	80 (R)	1969	J	RBLF.	D	4	1969	C
P14	Pleasant Grove Bapt. Church	1963	335	220	148	3	70 (R)	1963		CCKF.	A	10	1963	X
P17	Meriah Springs		339				+ (O)	1978	N,F	CTHL.	N	500	1977	C, P
P18	James Thomas	1971	420	472	462	2	192 (R)	1971	J	CTHL.	D	5	1971	C
P19	J. D. Logan	1971	392	140	135	2	100 (R)	1971	J	CTHL.	D	3	1971	C
P20	Waukaway Springs		369				+ (O)	1977	N,F	CTHL.	D	628	1977	C, P
P21	Lake Bounds (Spring)		369				+ (O)	1979	N,F	CTHL.	N	10(est)	1975	C
P22	Fairview Pent. Church	1975	263	130	126	2	15 (R)	1975	J	KOSC.	D	6	1975	C

RECORDS OF SELECTED WELLS IN CLARKE COUNTY

Well No.	Owner	Year Drilled	Altitude of land surface datum (feet)	Depth (feet) Well	Depth (feet) Top of screen	Casing diameter (inches)	Water level Above (+) or below LSD (feet)	Water level Date of measurement	Method of lift	Water bearing unit	Use	Yield Gallons per min.	Yield Date	Remarks
Q1	Southern Household	1967	200	167	127	8,6	18 (R)	1967	S	CCKF.	T	60	1967	C
Q2	Shell Oil Co.	1970	310	505	374	4,2	91 (R)	1970	A	CCKF.	I	60	1970	C, E, X
Q8	Southern Household	1968	200	145	120	8	18 (R)	1968	S		I	60	1968	
Q9	Southern Household	1969	205	918		6	15 (R)	1969	S	TLLT.	I	180	1969	
Q10	Southern Houshold	1967	200	378						KOSC.	T			
Q11	Roy Phillips	1972	392	260	255	2	61 (R)	1972	J	RBLF.	D	6	1972	C
Q12	Mary T. Young	1972	270	220		4	44 (R)	1972	S	KOSC.	D	10	1972	
Q13	Ruth Ann Heard	1971	380	410	405	4	175 (R)	1971	S	CCKF.	D	5	1971	
Q14	Donald Thomas	1961	385	420	410	2	170 (R)	1961	C	CCKF.	D			C, E
Q15	Flowing Well Sec. 12		200			3	+ (0)	1978	N,F	CCKF.	S	10	1978	C
Q16	Tribulation Church	1969	271	331	325	2	87 (R)	1969	J	CCKF.	D	8	1969	
Q17	Spring Sec. 1		280				+ (0)	1978	N,F	RBLF.	U	0.5	1978	C
R1	Town of Shubuta	1969	195	208	188	8	21 (R)	1969	T	CCKF.	P	50	1969	C, E
R2	Town of Shubuta	1971	192	2286	2246	8	65 (R)	1971	T	WLCX.	P	200	1971	C, E
R3	Hiwanee Wtr. Assn. T.H. #1	1976	270	2408						WLCX	T			E
R4	Hiwanee Wtr. Assn.	1976	275	2368	2298	10 3/4	+ 20 (R)	1977	T	WLCX.	P	448	1976	C, E, P
R7	Town of Shubuta	1921	195	550		3	+ 15 (R)	1955	N	KOSC.	P			C
R8	Town of Shubuta	1949	195	211	171	6	15 (R)	1955	T	CCKF.	P	74	1949	C
R9	Town of Shubuta	1971	192	978	948	4				MUWX.	T	60	1971	C, E
*R10	Alcinda Gates	1974	199	86	42	4	12 (R)	1974	B	ALLV.	D		1974	C, X
R11	Hansen Scales	1969	310	597	518	6	15 (R)	1969	T	KOSC.	S	180	1969	
R12	Roosevelt Jordan	1970	342	250	245	4	125 (R)	1970	J	CCKF.	D	10	1970	
R13	Flowing Well @ Shubuta		198			2	+ (0)	1978	N,F	CCKF.?	U	2.5	1978	C
R14	Flowing Well Sec. 20		198			3	+ (0)	1978	N,F	CCKF.	S	2	1978	C
R15	Flowing Well Sec. 32		180			3	+ (0)	1978	N,F	CCKF.	S	2	1978	
R16	Flowing Well Sec. 29		198			2	+ (0)	1978	N,F	CCKF.	S	3	1978	C
S1	Threadville Wtr. Assn.	1966	295	169	129	8	65 (R)	1966	S	CCKF.	P	115	1966	C
S4	Clyde McAdams	1970	310	320	315	4	104 (R)	1970	J	KOSC.	D	10	1970	C
S5	Robert Fleming	1972	260	165	160	4	47 (R)	1972	J	CCKF.	D	10	1972	C
S6	R. M. Lucus	1971	280	280	168	4	65 (R)	1971	J	KOSC	D	10	1971	C, X
S7	Geneva Jones	1971	300	154	142	2	82 (R)	1971	J	CCKF.	D.	7	1971	
S8	Mrs. J. M. Shaw	1956	315	388		2	79 (R)	1956	C	KOSC.	D			C
S9	Leanard F. Fagan	1970	260	235	230	4	42 (R)	1970	S	KOSC.	D	10	1970	
S12	L. E. Alston	1974	263	31	21	2	13 (R)	1974	J	CCKF.	D	6	1974	
S13	New & Hughes	1977	279	378		3	150 (R)	1977	A	CCKF.	I	55	1977	C

TABLE 2

RECORDS OF SELECTED CHEMICAL ANALYSES OF GROUND WATERS IN CLARKE COUNTY, MISSISSIPPI

*ANALYSIS BY U.S.G.S.
**ANALYSIS BY M.S.B.H.
M.G.S.

Well No.	Depth	Water Bearing Unit	Date Analyzed	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total Dissolved Solids	Hardness as $CaCO_3$: Calcium, Magnesium	Hardness as $CaCO_3$: Non-carbonate	Specific Conductance (micromhos at 25° C)	pH	Temperature (°F)	Color
																Dissolved constituents and hardness given in milligrams per liter						
A1	1,225	WLCX.	1978	10	.1								8.0	.1		266			410	8.0	80	10
*A1	1,355	WLCX.	1967	14	.11	2.0		90	.7	235		1.0	6.8	.1	.1	234	5		375	8.4	83	10
A2	1,336	WLCX.	1978		.15							.5	17			182	6		280	8.1	80	10
*A7	250	MUWX.	1967	18	.02	2.0	0	102	1.2	273		7.8	2.0	.1		283			436	7.7		40
*A7	250	MUWX.	1965	1.6	0	0	0					17	11	0		219			337	8.7		70
A8	335	MUWX.	1977	2	.1						20	8	10			234	5		360	8.3	53	30
A9	151	KOSC.	1978	4.1	.15								5.0			429	37		660	6.9	66	45
A10	1,242	WLCX.	1967	21	.08	2.0		147	1.0	384		.4	5.8	.1		385	5		593	8.0	82	10
A11	120	KOSC.	1978		.21								5.0			260	8		400	6.2	66	12
A12	147	MUWX.	1978		.2							6	.5			292	6		450	7.8	65	33
A13	132	KOSC.	1978	1.7	.22							2.5				195	7		300	6.2	65	15
A14		ALLV.	1978	20	.05											234	15		360	8.4	69	190
A15		KOSC.	1978	2.0	.15							20	10			247			380	8.4	71	50
A16	241	MUWX.	1978	1.0	1.1							10				292	100		450	7.5	71	15
A17	99	KOSC.	1978		.38		60					.2	10			39	7		60	6.4	53	15
B1	378	MUWX.	1978		1.3							15	1.0	.1		128	23		198	7.2	73	13
**B1	378	MUWX.	1968	46	1.1	9.9	.8	23	1.3	86		10	1.3	.1		143	28		169	7.0	69	10
*B3	1,381	WLCX.	1975	18	.28	1.6	.5	72	1.8	163		2.6	22	.2		206	6		260	7.8	80	5
B7	340	MUWX.	1978	39	1.0	7.1						9.1	.8	.1		98			150	7.0	67	8
*B8	69	KOSC.	1968	8.3	.3	2.0	.7	1.8	.2	16	0	.2	.6	0	0	234	8		360	6.5	66	10
B9		KOSC.	1978		.3							.2	.4	0		213	6		328	6.6	69	50
B12		KOSC.	1978		.2							.1	.4	0		195	6		300	6.7	68	35

Well No.	Depth	Water Bearing Unit	Date Analyzed	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total Dissolved Solids	Hardness as $CaCO_3$: Calcium, Magnesium	Hardness as $CaCO_3$: Non-carbonate	Specific Conductance (micromhos at 25° C)	pH	Temperature (°F)	Color
				Dissolved constituents and hardness given in milligrams per liter																		
C1	1,270	WLCX.	1978	16	.3					177		4.0	7.0	0		104	5		192	7.1	78	10
*C1	1,270	WLCX.	1967	15	.3	2.4		62	1.3	162		4.4	6.6			181	6		283	7.2	78	5
**C1	1,270	WLCX.	1965	1.2	.2	1.6	1.0					5.4	12	0		108	8			8.2	77	
C5	96	MRDN.	1978		.1								3.0	0		331	28		510	6.9	69	30
C6	63	KOSC.	1978	13	.2					10	0	.1	.3	0		141	5		217	6.8	66	11
C7	176	MUWX.	1978		.1					66	0	6	1.0	.1		92			143	6.9	70	10
C8	87	KOSC.	1978	10	.3					42	3	.9	.2	0		122	8		188	7.0	69	6
D3	240	MRON.	1978	3.0	.9							.2	5.0	0		182	42		280	7.0	68	10
D5	220	WLCX.	1978	1.2	.1							.3	17	0		142	36		219	6.9	71	5
D6	400	WLCX.	1978		.2							.1	10	.1		130	24		200	7.0	72	0
D8	SPR.	MUWX.	1978	4.4	.1							2	11	0		122	13		188	6.8	70	15
D9	282	WLCX.	1978	2.2	.1							1	21	.1		72	10		110	6.9	71	0
E5	216	WLCX.	1978	2.2	.2							.2	17	0		124	20		191	6.9	71	0
E6	175	WLCX.	1978	1.7	.3							1	10	0		107	15		166	7.0	72	0
E7	262	WLCX.	1978	1.8	.3							5	8	0		118	11		182	7.1	70	0
F4	250	KOSC.	1978	22	.3							0	.5	0		130	5		200	7.6	70	7
F5	231	MUWX.	1978	2.7	.05							17	3.0	.1		338	9		520	7.0	66	70
F7	196	KOSC.	1978	10	.95							.2	10	0		149	43		230	6.3	69	35
F8	220	KOSC.	1978	17	.3							0	.1	0		137	13		211	7.7	70	5
F9	63	KOSC.	1978	14	.3							0	.4	.2		285	4		439	6.8	65	57

Well No.	Depth	Water Bearing Unit	Date Analyzed	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total Dissolved Solids	Hardness as $CaCO_3$: Calcium, Magnesium	Hardness as $CaCO_3$: Non-carbonate	Specific Conductance (micromhos at 25° C)	pH	Temperature (°F)	Color
				Dissolved constituents and hardness given in milligrams per liter																		
G1	1869	WLCX.	1978	8	.17								140	.2		679	7		1045	8.2	89	0
**G1	1869	WLCX.	1973	0	1.0	2.4	2.43	223.6				10.2	200	0		369			569	8.4		
*G1	1869	WLCX.	1973		.1								220			672			1035	8.2	89	0
**G2	1597	WLCX.	1977		.1	0	0	83	.6			4.3	15	.3		202				7.8	83	10
G2	1597	WLCX.	1978	12	.1							3.8	10	.3		130	8		200	7.6	84	8
*G5	310	MRDN.	1969		.1							0	5			203	37		313	6.8		
*G6	411	MUWX.	1954	4.4	.05	.6	.1	88	1.6								2			8.9	67	3
*G8	273	KOSC.	1964	36	.26	0	0	53	.8			7.8	3.3	.1		143	0		221	7.8	67	5
G9	SPR.	KOSC.	1978	26	.3							6.2	2.6	.1		157	0		242	7.7	69	7
**G13	410	MUWX.	1968	2.4	.1	0	0				0	22	3	.2		242	0			9.0		
G14	260	CCKF.	1978	21	.3					202		3.2	7	.2		331	80		536	7.8	66	10
H2	335	MUWX.	1978	20	.2					76	0		1.5			122	6		189	7.0	65	0
**H2	335	MUWX.	1976		.15	2.9	.4	46	3.0		12	5.9	10	.3		114	88			7.2		
H3	335	MUWX.	1978		.18	1.7				53	0		5	0		138			213	7.1	67	3
*H8	175	KOSC.	1963	45	.5	27	2.1	33	4.1	113	0	49	3.8	0	0	220	76			6.9		15
*H11	320	KOSC.	1969	0	.3	14	1.7	16	1.5			0	2.0	.4		81	42			6.1		
**H11	320	KOSC.	1969	0	.3	14	1.7	15.7	1.5		131	0	2.0	.4		82	76			6.1		
H11	320	KOSC.	1978	0	.3								2.5	.3		116			179	6.5	69	5
*H13	384	MUWX.	1968	50	.3	1.5	.5	44	.9	114	0	4.6	4.0		0	130	6		200	7.2	61	0
*H13	384	MUWX.	1967	50	.3	1.5	.5	44	.9	114		4.6	4.0	0			6		200	7.2		0
H14	168	KOSC.	1978	0	.2								2.5	.2			37			6.5	66	12

Well No.	Depth	Water Bearing Unit	Date Analyzed	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total Dissolved Solids	Hardness as $CaCO_3$: Calcium, Magnesium	Hardness as $CaCO_3$: Non-carbonate	Specific Conductance (micromhos at 25° C)	pH	Temperature (°F)	Color
						Dissolved constituents and hardness given in milligrams per liter																
J3	309	WLCX.	1978	38	.3							4.2	3.0	.1		146	53		225	6.8	72	17
J4		KOSC.	1978	10	.3							0	2.5	0		161	19		248	6.8	69	10
J5	380	MUWX.	1978	17	.2							2.1	1.0	.1		213	22		329	7.0	70	27
J6	151	MRDN.	1978	23	.1							3.0	0	0		171	26		210	6.9	71	12
J7	89	KOSC.	1978	8	.2							0	0	0		122	10		189	6.8	70	10
K1	1,393	WLCX.	1978	12	.1							8.3	25	.2		284	5		437	7.8	77	12
*K1	1,393	WLCX.	1977		.1	1.2	.2	110	.5		4	9.1	31	.3		266	4			8.0	78	10
**K1	1,393	WLCX.	1975	15	.09	1.9	.4	110	.8	240		1.7	31	.3		263	6		405	8.4		0
K2	1,349	WLCX.	1978	13	.1							5.3	42	0		295	8		454	7.5	76	15
**K2	1,349	WLCX.	1977		.1	1.6	1.0	103	.6			6.9	35			284	8		437	8.1	78	10
K6	158	WLCX.	1978	18	.1							1.6	15	.2		246	9		379	7.7	74	5
K8	258	MUWX.	1978	19	.2							1.0	3.0	.1		187	5		289	7.5	71	9
L1	330	KOSC.	1978	3.2	.2							9.2	19	0		299	3		460	8.0	69	6
**L1	330	KOSC.	1972	2.8	.2	2.0	.97				3	11	14	0		294				8.2	68	5
*L1	330	KOSC.	1978		.1								7.0							8.6		
*L3	843	MUWX.	1969	12	.06	.8	.5	169	2.2	422			3.0	.4		419	4		645	8.4		200
**L3	843	MUWX.	1969		.1						0		6							8.7		110
*L7	460	KOSC.	1969		1.0								5.0				55			6.7		
**L7	460	KOSC.	1969		1.0						64		5.0				55			6.7		

Well No.	Depth	Water Bearing Unit	Date Analyzed	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total Dissolved Solids	Hardness as $CaCO_3$		Specific Conductance (micromhos at 25° C)	pH	Temperature (°F)	Color
																	Calcium, Magnesium	Non-carbonate				
				Dissolved constituents and hardness given in milligrams per liter																		
L7	460	KOSC.	1978	2.2	1.3						8	16.3	9.0	.2		225			347	6.3	72	7
**L8	370	KOSC.	1967	53	.26	28	3.4	37	3.3	179		8.8	5.0	0		225	84		347	6.6		5
*L10	138	CCKF.	1968	25	.5	20	7.3	89	8.1	282		32	11	.2		348			536	7.8		10
L11	192	CCKF.	1978	10	.1								.14	0		260	8		400	6.4	83	30
L12	90	CCKF.	1978	32	.1							20	.10			257	7		396	6.6	80	18
*M1	169	KOSC.	1967	38	.42	2.2	.7	268	2.7	722		.8	3.5	1.1		689	8		1060	7.9		12
M2	306	KOSC.	1978	20	.1							9.9	5.3	.3		424	17		653	7.6	77	100
**M2	306	KOSC.	1967	17	.08	5.0	1.2	139	2.5	374		8.2	4.8	.4		931	17		603	7.6		80
M3	1,934	WLCX.	1978		.15								142	.2		690	18		1063	8.0	87	7
**M3	1,934	WLCX.	1975		.1	2.4	1.7	263	1.4			7.7	258	.3		648	13			8.3	85	
*M4	245	KOSC.	1967	17	.08	5.0	1.2	139	2.5	374		8.2	4.8	.4		390			600	7.6		
**M9	230	KOSC.	1967	0	.1	6.0	0					0	8.0	.5		378			582	8.6		100
*M11	289	KOSC.	1967	47	.18	19	3.1	28	2.4	143		6.0	1.7	.1		157	60		243	6.8		5
*M13	204	KOSC.	1959	11	.1	21	2.9					11	3.0	.2		235	73		363	7.0		5
*M13	204	KOSC.	1857	23	.07	23	4.3	4.1	185			10	3.0	.2		209	75		322	7.5		12
M18		CCKF.	1978	2.9	.18						40	2.5	5	0		650	17		1000	6.4	74	130
M19	SPRING	CCKF.	1978		.2						29	1.6	2	0		603	12		928	6.5	67	100
M20		CCKF.	1978	4.2	.15							2.0	3.0	0		492	27		757	6.7	73	59
M21		CCKF.	1978	1.7	.3							2.2	5.0	0		638	16		982	6.5	68	76
M22	275	KOSC.	1978	0	.05							22	3.7	.05		331	22		510	7.2	71	29
*M22	275	KOSC.	1969	0	0	2.4	1.0	118	2.0			36	4.0	0		306	10		472	8.2		25
**M22	275	KOSC.	1969	0	0	2.4	.97	118	2.0		0	36	4.0	0		305	10		470	8.2	70	25

Well No.	Depth	Water Bearing Unit	Date Analyzed	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total Dissolved Solids	Hardness as $CaCO_3$: Calcium, Magnesium	Hardness as $CaCO_3$: Non-carbonate	Specific Conductance (micromhos at 25° C)	pH	Temperature (°F)	Color
										Dissolved constituents and hardness given in milligrams per liter												
N12	318	KOSC.	1978	20	.3							2.3	2.6	.1		141			218	7.2	66	10
N13	195	KOSC.	1978	38	.4							2.0	1.1	0		179			276	7.0	65	8
N17		KOSC.	1978	14	.3							4.2	1.0	0		213			328	7.3	66	28
*03	219	KOSC.	1968	38	11.0	22	4.4	15	2.2	129	0	2.4	2.8	.1	.1	141	73		218	7.2	77	10
*03	400	MUWX.	1968	23	1.0	3.6	0	75	.6	168	0	34	2.0		.1	224	9		346	7.0	79	10
06	147	TLLT.	1978	43	.3							.4	3.0	.7		826	52		1272	7.8	72	14
07	236	MRDN.	1978	18	18	.3						.3	4.3	0		187	18		289	7.0	70	12
P3	624	CCKF.	1978	12	.1							24	3.0	.1		367	28		565	6.8	69	0
P4	150	CCKF.	1978	15	.2							21	4.0	.1		308	10		475	6.9	68	15
P5	474	CCKF.	1978	8	.2							12	2.5	.2		331	17		510	6.7	70	17
P13	110	RBLF.	1978	20	.5							10	5.3	.2		306	192		472	7.9	72	17
P17	SPRING	CTHL.	1978	16	.1							29	50	.1		71	37		110	6.6	63	0
P18	472	CCKF.	1978	27	.1							18	37	.1		333	12		513	6.7	68	21
P19	140	CTHL.	1978	18	.05							13	21	.1		63	7		98	6.5	66	0
P20	SPRING	CTHL.	1978	21	.1							8	77	0		81	38		126	6.5	62	9
P21	SPRING	CTHL.	1978	4.4	.3							5	44	.2		77	57		119	6.6	63	10
P22	130	CCKF.	1978	34	.2							20	2.0	0		303	63		467	6.7	71	15
Q1	167	CCKF.	1978	10	.1							30	11	.1		431	17		578	7.5	72	8

Well No.	Depth	Water Bearing Unit	Date Analyzed	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Total Dissolved Solids	Hardness as $CaCO_3$: Calcium, Magnesium	Hardness as $CaCO_3$: Non-carbonate	Specific Conductance (micromhos at 25°C)	pH	Temperature (°F)	Color
												Dissolved constituents and hardness given in milligrams per liter										
Q1	167	CCKF.	1978	10	.1							30	11	.1		431	17		578	7.5	72	8
Q2	374	CCKF.	1978	15	.2							22	37	.2		441	26		679	7.3	77	13
Q11	260	RBLF.	1978	8	.3							18	26	.1		335	9		516	7.0	68	20
Q14	420	CCKF.	1968	10	.1	6.0	2.3	135	1.3	300		43	21	.5		405	25		644	7.7		10
Q15		CCKF.	1978	8	.2							13	8	.2		331	16		510	7.6	70	3
Q17	SPRING	RBLF.	1978	21	.1							15	0			154	10		237	7.2	66	18
R1	208	CCKF.	1978	5	.1							38	25							7.8	71	
R2	2292	WLCX.	1978	22	.1							12	72	.1		122	14		189	8.1	92	18
*R2	2286	WLCX.	1971		.1								63				5			8.5		15
R4	2385	WLCX.	1978	1.3	.15							5	77	.1		552	8		850	8.3	98	12
**R4	2385	WLCX.	1976		.15								88							8.2		10
*R7	550	KOSC.	1921	0	.2	2.7	1.0	294	5.6	713		3.6	7.2	0	2.2	741	10	0	1140	8.6	69	200
*R8	211	CCKF.	1967	3.6	.12	4.6	1.3	182	5.0	436		33	22		1.5	517	17		796		72	45
R9	978	MUWX.	1971	20	.2								11	.2		374			576	8.0		140
R10	86	CCKF.	1978	4	.1								3	0		331	4	0	510	8.2	77	28
R13		CCKF.	1978	1.7	.1								.14	.1		747	7		1150	7.6		325
R14		CCKF.	1978	2.1	.1								.1	.3		634	3		976	7.5	75	37
R16		CCKF.	1978	2.5	.05								0	0		234			360	7.5	66	15
S1	169	CCKF.	1978	11	.7							22	18	0		122	60		188	5.9	66	5
**S1	169	CCKF.	1966		.7								17				78			5.9	64	
S4	320	KOSC.	1978	9	.3	14						10	5.0	.1		111	52		172	7.1	74	5
S5	165	CCKF.	1978	10	0	2.7						25	18	.2		402	16		619	8.3	70	50
S6	168	KOSC.	1978	38	.3	18						1.4	.8	.1		125	73		200	7.2	68	10
S8	388	KOSC.	1978	18	4	10						.7	.4	0		159	45		179	7.2	71	10
S13	378	KOSC.	1978	2	.1	3.0						8	3.0	.1		206	12		318	8.3	73	50

In addition to the field verification and analyses of ground-water data, 66 test holes were drilled in Clarke County. These test holes are from 37 feet deep (Sec. 10, T.3 N., R.14 E.) to 420 feet deep (Sec. 1, T.10 N., R.9 W.). All test holes were logged with a "single point" electrical logger, and samples of cuttings were collected at 10-foot intervals. The electrical logs of these 66 test holes provide information regarding the composition, stratigraphic position, and thickness of the fresh-water aquifers in the subsurface of Clarke County.

Present Ground-Water Use

Callahan (1975) states that thirteen municipal and rural water associations in Clarke County withdraw a total of 0.877 million gallons per day of ground water. Well depths for these water associations are from 2386 feet (Sec. 10, T.10 N., R.7 W.) in southern Clarke County, to 169 feet (Sec. 6, T.1 N., R.18 E.) in southeastern Clarke County (Table 3).

These water associations utilize three aquifers to provide ground water to over nine thousand persons. Harmony Water Association is the largest single rural water association in Clarke County having two Wilcox and three Kosciusko wells.

The second largest withdrawal of ground water in Clarke County is from rural self-supplied wells. All of Clarke County is underlain by at least two aquifers that can yield enough ground water for rural self-supplied use. Callahan (1975) indicates that total rural self-supplied ground-water withdrawal in Clarke County exceeds 0.431 million gallons per day. Rural water wells in Clarke County vary in depth from 69 feet for a Kosciusko well in northern Clarke County (Sec. 22, T.4 N., R.15 E.) to a 565 foot Meridian/Upper Wilcox well in the east-central part of the county (Sec. 10, T.3 N., R.14 E.) (Table 1).

Callahan (1975) indicates that industrial sources withdraw 0.117 million gallons per day of ground water in Clarke County. This small amount of industrial ground-water withdrawal indicates that there are few large industries located in the county. Textile and paper wood industries are currently the largest industrial consumers of ground water in Clarke County. The potential development of several aquifers, each capable of large yields, and the present underdeveloped status of the area should help attract future industries to the county.

TABLE 3

RURAL AND MUNICIPAL WATER ASSOCIATION WELLS IN CLARKE COUNTY, MISSISSIPPI

WELL NO.	OWNER	ELEVATION (FT.)	WELL DEPTH (FT.)	CASING (IN.)	SCREEN LENGTH (FT.)	AQUIFER	STATIC WATER LEVEL (FT.)	YIELD (G.P.M.)	ANALYSIS NO.
A7	Town of Enterprise	260	250	10	30	MUWX	16	155	A7
B1	Harmony Water Association Well #1	360	378	8 5/8	41	MUWX	106	200	B1
B3	Harmony Water Association Well #3	445	1,381	8 5/8	40	WLCX	135		B3
C1	Clarksdale Water Association	539	1,270	10, 6	50	WLCX	247	164	C1
G1	City of Quitman Well #2	302	1,869	12, 8	107	WLCX	10	475	G1
G2	Town of Stonewall Well #2	341	1,597	12 3/4	90	WLCX	53	750	G2
G13	Town of Stonewall Well #1	240	410	12	34	MUWX		292	G13
H11	East Quitman Water Association Well #1	340	320	10	40	KOSC	125	230	H11
K1	East Quitman Water Association Well #2	498	1,393	12 3/4	70	WLCX	246	200	K1
K2	East Quitman Water Association Well #3	462	1,349	12 3/4	40	WLCX	202	250	K2
L1	Barnett Water Association Well #1	310	330	4	20	KOSC	80	40	L1
L7	Town of Pachuta Well #2	260	460	10	60	KOSC	60	200	L7
L8	Town of Pachuta Well #1	320	370	6	30	KOSC	14	150	L8

M2	Harmony Water Association Well #2	310	306	10 3/4	62	KOSC	112	200	M2
M3	City of Quitman Ind. Park Well	227	1,934	12, 8	104	WLCX	61	709	M3
M4	De Soto Water Association Well #1	299	245	10, 8	60	KOSC	99	200	M4
M9	Harmony Water Association	295	230	10	30	KOSC	98	112	M9
M11	City of Quitman Well #2	230	289	10	42	KOSC	15	608	M11
M22	Harmony Water Association	300	275	10	45	KOSC	47		M22
P2	Beaver Dam Water Association Well #1	470	600	4, 2	30	CCKF	230	35	
P3	Beaver Dam Water Association Well #2	465	624	4	30	CCKF	208	30	P3
R1	Town of Shubuta	195	208	8	20	CCKF	21	50	R1
R2	Town of Shubuta	192	2,286	8	40	WLCX	65	200	R2
R4	Hiwanee Water Association	275	2,386	10 3/4	78	WLCX	+20	448	R4
R8	Town of Shubuta	195	211	6	40	CCKF	15	74	R8
S1	Theadville Water Association Well #1	295	169	8	40	CCKF	65	115	S1

Ground Water Availability

Springs and flowing wells are abundant in Clarke County because the hydrostatic pressure (head) within the Wilcox, Meridian, Kosciusko, and Cockfield aquifers is great enough to force the ground water to rise above the land surface in some areas. There are seven springs and thirteen flowing wells in Clarke County with a combined yield of over 1700 gallons per minute (Table 1). The flowing wells and springs in the county are located at lower elevations, or in the alluvial plains of rivers and streams. These flowing wells in Clarke County are small, 2"- 3" diameter wells with individual yields of 1-10 gallons per minute. The water from these flowing wells and springs is of fair to good quality, and is used for recreation, irrigation, livestock watering, or small fish ponds (Tables 1 and 2).

The average depth of most rural self-supplied wells in Clarke County is between 100 to 200 feet. Large capacity industrial, municipal, and public water wells are deeper, generally 400 to 500 feet. The deeper aquifers usually yield water of superior quality and in superior quantity in relation to the shallower aquifers (Table 2).

Wilcox sands are the deepest dependable source of fresh ground water in Clarke County (Fig. 1). From its outcrop in northeastern Clarke County, the unit has a regional dip to the southwest of 40 to 50 feet per mile. Wells completed in the Wilcox aquifers vary in depth from less than 30 feet (Sec. 8, T.4 N., R.18 E.) in the outcrop area in extreme northeastern Clarke County, to 2386 feet (Sec. 10, T.10 N., R.7 W.) in the southern part of the county (Tables 1 and 2). The excellent quality and quantity of water produced from the Wilcox aquifers makes them a better ground-water source than the shallower aquifers which may need major treatment such as filtration or ion exchange to remove excess iron, color, or dissolved solids.

The base of the Wilcox Group generally marks the base of the fresh water, except where faulted structures have impeded the normal downdip flow of fresh water from the surface (Fig. 3). The City of Quitman's 1869-foot lower Wilcox well has been increasing in chlorides and total dissolved solids over the past six years. The well is located within an area of faulting and oil field production, and the increase in total dissolved solids may be caused by 1)

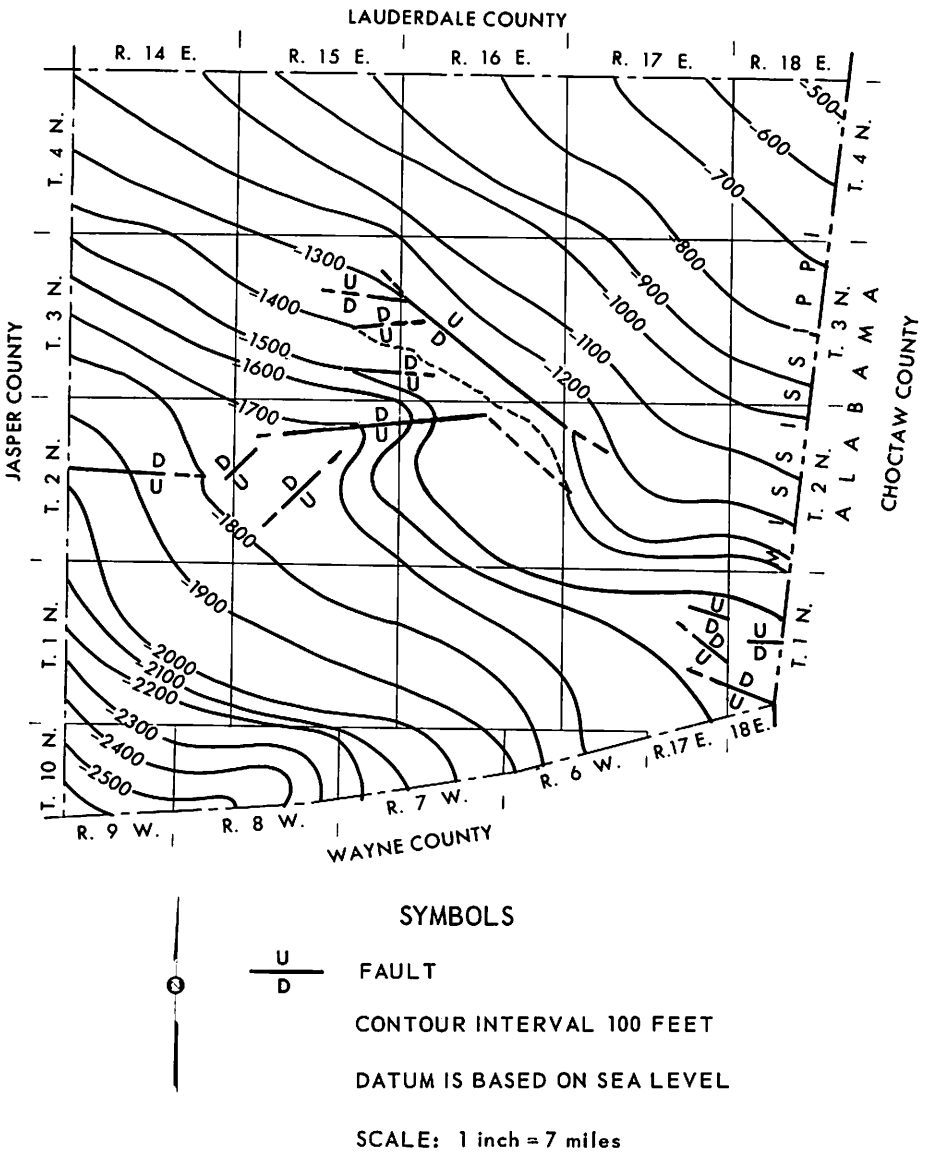

Figure 3–Configuration of the base of fresh water in Clarke County, Mississippi.

proximity to structurally sequestered portions of the aquifer which yield inflow of relatively stagnant ground water, 2) brine contamination from improperly constructed salt water disposal wells in nearby Quitman, Davis, and Frances Creek Fields.

The Meridian Sand member of the Tallahatta Formation consists of sands which are in some areas hydraulically connected with the upper Wilcox Group. The Meridian Sand is extremely variable in thickness and lithology, but Foster (1940) indicates the Meridian Sand reaches its maximum thickness of 100 feet in Lauderdale County. Downdip to the southwest, the Meridian thins to about 60 feet in the subsurface of west-central Clarke County. Water produced from the Meridian aquifers is of fair quality, but with iron concentrations above 0.3 mg/l and excess color being potential quality problems (Table 2).

The Kosciusko (Sparta) Formation crops out in an irregular arc across the northern half of Clarke County. Boswell (1970) states that the Kosciusko is 100 feet thick near the Alabama-Mississippi state line in Clarke County. The formation thickens downdip to the southwest from its outcrop in Clarke County. Luper and Baughman (1972) indicate the Kosciusko is 200 feet thick in Smith County. Because the Kosciusko Formation is shallower than the Wilcox, and produces better quality water than the overlying Cockfield, the Kosciusko Formation is the most intensively developed source of ground water in Clarke County.

The Cockfield Formation from its outcrop in central Clarke County has a regional dip to the southwest of 40 to 50 feet per mile. Thomas (1940) stated the Cockfield maintains a constant thickness of about 50 feet at the surface, but test hole data indicate the formation thickens in the subsurface to over 100 feet in south-central Clarke County. Water produced from the Cockfield may need treatment for removal of excess iron and color, but the formation is the shallowest dependable source of ground water in the southern third of the county. The quality of Cockfield water may be less than desirable, but the large quantities of ground water at shallow depths make the formation a reliable source of ground water for rural self-supplied use.

Structure

Clarke County is located in the eastern area of the Pickens-Gilbertown fault system. This fault system extends generally east-west across the county. Priddy (1960) indicates the system extends

from Gilbertown, Alabama, to Pickens, Mississippi. The faulting in Clarke County was first reported by Tourtelot (1944), who identified the Quitman fault zone. Faulting presently delineated by electrical log data in the county includes five major faults and at least eight unnamed minor faults (Gilliland, Plates I and II). Major faults having displacement up to 150 feet include the Quitman, Clarkco, Linton, Gilbertown, and Pachuta faults. Minor faults confirmed by test-hole drilling in the county have displacement up to 50 feet.

The faulting is restricted to township 2 N. and 3 N. in central Clarke County and along Langsdale and Double Creek Fields in the southeastern part of the county. This faulting has directly influenced the fresh-water aquifers by causing 1) lithologic displacement from 50 to 150 feet, 2) nonuniform local dip, 3) abrupt changes in the regional dip, 4) abrupt changes in the static water levels in wells in the fault zones, and 5) possible salt-water migration along fault planes to shallow fresh-water aquifers.

Ground-Water Quality

The chemical properties of the ground water in Clarke County may vary within a small radius from a given water well. Natural chemical variations in the ground water may be the result of either the original environment of deposition or contamination by man-made pollutants.

The ground water in Clarke County is soft and of the calcium-magnesium bicarbonate or sodium-magnesium bicarbonate types. Calcium and magnesium are the common minerals causing hard water. Excessive hardness in ground water results in a waste of soap, a toughening of vegetables cooked in hard water, and the formation of scale deposits in boilers, hot water heaters, and plumbing fixtures. Water with a hardness of 50 mg/l or less is considered soft and water with a hardness of 50 to 150 mg/l is considered hard, has a bad taste, and must be treated by the lime-soda ash or ion exchange methods to remove excess hardness.

Hardness of the ground water produced in Clarke County varies from 5 to 192 mg/l; the average hardness of most ground water is 30 mg/l. A well completed in the Red Bluff Formation in southwestern Clarke County (Sec. 4, T.10 N., R.9 W.) produces water with a hardness of 192 mg/l, which is the "hardest" ground water reported in the county.

High total dissolved solids is the most common problem in water from the Cockfield, Kosciusko, Meridian, and Wilcox aquifers in Clarke County. High total dissolved solids in ground water prohibits its use for various industrial purposes such as air conditioning, baking, canning, raw water ice, laundering, and tanning (Table 4). Water of good quality will have total dissolved solids below 500 mg/l, which will meet the requirements of most industrial and domestic uses with little or no treatment. Water containing high total dissolved solids (500 to 1000 mg/l) is unsatisfactory for most uses without major treatment. Water with total dissolved solids above 1000 mg/l is not suitable for most purposes because it can be corrosive to metal pipes and fixtures.

In Clarke County the total dissolved solids content in the ground water produced from fresh water aquifers varies from less than 100 mg/l to over 700 mg/l. Shallow wells less than 200 feet deep in Clarke County produce ground water with total dissolved solids less than 250 mg/l, but the dissolved solids increase downdip to the southwest to the fresh water-saltwater interface (Fig. 3).

The pH of ground water in the county can be as low as 5.9 in shallow wells located near or in an aquifer's outcrop area. Two Cockfield wells located in the formation's outcrop area produce "acid water." Downdip the pH of most ground water will increase to near neutral (7.0). Wilcox water having a pH of 8.6 has the best overall quality of any ground water analyzed in the county.

Iron concentrations in excess of 0.3 mg/l will give water a bad taste and damage plumbing fixtures. Concentrations greater than 0.3 mg/l occur in the low pH water produced from the Catahoula Formation which crops out in the extreme southwestern part of the county. The Cockfield and Kosciusko aquifers immediately downdip of their respective outcrop areas produce water than contains iron concentrations in excess of 0.3 mg/l. Downdip the iron concentration in water from both aquifers decreases to less than 0.2 mg/l.

Excess color is not a problem in water produced from the Wilcox aquifers, but is common in water from the Kosciusko and Cockfield aquifer. This "organic color" in the ground water is due to lignite interbedded with the sand. Water with such an organic color will need major treatment such as coagulation, sedimentation, or filtration to solve this quality problem.

Table 4 — Water-quality tolerances for industrial applications.

(American Water Works Association, 1950, Water quality and treatment, p. 67, table 3-4. Remarks: A, no corrosiveness; B, no slime formation; C, conformance to Federal drinking water standards; D, Al_2O_3 less than 8 ppm, SiO_2 less than 25 ppm, Cu less than 5 ppm. Chemical constituents in parts per million.)

Industrial Use	Turbidity	Color	Fe	Mn	Fe+Mn	Hardness	Alkalinity	pH	Total solids	Remarks
Air conditioning 1/	.....	.....	0.5	0.5	0.5	.....	.....	.....	.....	A,B
Baking	10	10	0.2	0.2	0.2	(?)	.....	.....	.....	C
Boiler feed:										
0-150	20	80	.....	.....	.....	75	.....	8.0+	3000-1000	
150-250	10	40	.....	.....	.....	40	.....	8.5+	2500-500	
250 psi and up	5	5	.....	.....	.....	8	.....	9.0+	1500-100	
Canning:										
Legumes	10	.....	0.2	0.2	0.2	25-75	.....	.....	.....	C
General	10	.....	0.2	0.2	0.2	.....	.....	.....	.....	C
Carbonated beverages 3/	2	10	0.2	0.2	0.3	250	50	.....	850	C
Confectionery	.....	.....	0.2	0.2	0.2	.....	.....	(4)	100	
Cooling 5/	50	.....	0.5	0.5	0.5	50	.....	.....	.....	A,B
Ice (raw water) 6/	1-5	5	0.2	0.2	0.2	.....	30-50	.....	300	C
Laundering	.....	.....	0.2	0.2	0.2	50	.....	.....	.....	
Plastics, Clear, uncolored	2	2	0.02	0.02	0.02	.....	.....	.....	200	
Paper and pulp 7/										
Groundwood	50	20	1.0	0.5	1.0	180	.....	.....	.....	A
Kraft pulp	25	15	0.2	0.1	0.2	100	.....	.....	300	
Soda and sulfite	15	10	0.1	0.05	0.1	100	.....	.....	200	
Light paper, HL-grade	5	5	0.1	0.05	0.1	50	.....	.....	200	B
Rayon (viscose) pulp:										
Production	5	5	0.05	0.03	0.05	8	50	.....	100	D
Manufacture	0.3	.....	0.0	0.0	0.0	55	.....	7.8-8.3	.....	
Tanning 8/	20	10-100	0.2	0.2	0.2	50-135	135	8.0	.....	
Textiles:										
General	5	20	0.25	0.25	.....	20	.....	.....	.....	
Dyeing	5	5-20	0.25	0.25	0.25	20	.....	.....	.....	
Wood scouring 10/	.....	70	1.0	1.0	1.0	20	.....	.....	.....	
Cotton bandage	5	5	0.2	0.2	0.2	20	.....	.....	.....	

1/ Waters with algae and hydrogen sulfide odors are most unsuitable for air conditioning.
2/ Some hardness desirable.
3/ Clear, odorless, sterile water for syrup and carbonation. Water consistent in character. Most high-quality filtered municipal water not satisfactory for beverages.
4/ Hard candy requires pH of 7.0 or greater, as low value favors inversion of sucrose, causing sticky product.
5/ Control of corrosion is necessary as is also control of organisms, such as sulfur and iron bacteria, which tend to form slimes.
6/ $Ca(HCO_3)_2$ particularly troublesome. $Mg(HCO_3)_2$ tends to greenish color. CO_2 assists to prevent cracking. Sulfates and chlorides of Ca, Mg, Na should each be less than 300 ppm (white butts).
7/ Uniformity of composition and temperature desirable. Iron objectionable since cellulose absorbs iron from dilute solutions. Manganese very objectionable, clogs pipelines and is oxidized to permanganates by chlorine, causing reddish color.
8/ Excessive iron, manganese, or turbidity creates spots and discoloration in tanning of hides and leather goods.
9/ Constant composition; residual alumina less than 0.5 ppm.
10/ Calcium, magnesium, iron, manganese, suspended matter, and soluble organic matter may be objectionable.

Aquifers

Wilcox Group (undifferentiated)

The Wilcox Group is composed of sediments which crop out in an arc that extends from Lauderdale and Clarke Counties in southeastern Mississippi to Tippah County in northeastern Missis-

sippi. In the subsurface of Clarke County the Wilcox sediments dip to the southwest at about 40 to 50 feet per mile (Fig. 4). The Wilcox Group is composed of interconnected sands which are connected hydraulically in some areas with the overlying Meridian Sand. Regional studies by Boswell (1963, 1970, 1976), Callahan (1971, 1975), Cushing (1964), Hosman (1968), and Thomas (1942) indicate that the Wilcox Group is composed of deltaic sediments deposited as "offlapping depositional wedges." Erratic shoestring sands within the Wilcox Group having irregular thickness are believed to be fluvial channel deposits.

Callahan (1975) states that the Wilcox aquifers in Clarke County supply nine municipal and rural water associations and three industries with 700,000 gallons of ground water per day. Transmissibilities for the Wilcox aquifers are often more than 170,000 gallons per day/foot (Table 5). Individual sand thicknesses within the Wilcox aquifers often exceed 100 feet, but are extremely variable due to the fluvial environment of deposition. Movement of ground water within the Wilcox aquifers in Clarke County is downdip to the southwest except where graben faulting has caused a reversal in ground-water movement and dip direction (Fig. 4). Static water levels in Wilcox wells are from less than 130 feet to more than 400 feet above mean sea level. Wells completed in the Wilcox aquifers in Clarke County have enough hydrostatic head to cause the static water level to rise to within a few feet of the ground surface. Wilcox wells located in areas of lower elevations in the county will flow. The Helms' Hereford Farm Wilcox well (Sec. 2, T.4 N., R.14 E.) flowed 500 gpm with a static water level 30 feet above the ground surface.

Water produced from the Wilcox aquifers is soft and of the sodium bicarbonate type. The bicarbonate water found in the Wilcox may be unsuitable for some industrial purposes, but it can be used for most domestic, municipal, or public water supplies without major treatment. The total dissolved solids are less than 100 mg/l in northern Clarke County, but the dissolved solids increase to more than 500 mg/l downdip in water from the deeper Wilcox aquifers in the central and southern parts of the county.

Water from the Wilcox Group has a pH of between 7.2 and 8.5. The higher pH values can be found in water produced from the 2386 foot Hiwanee Water Association's lower Wilcox well (Sec. 10, T.10 N., R.7 W.).

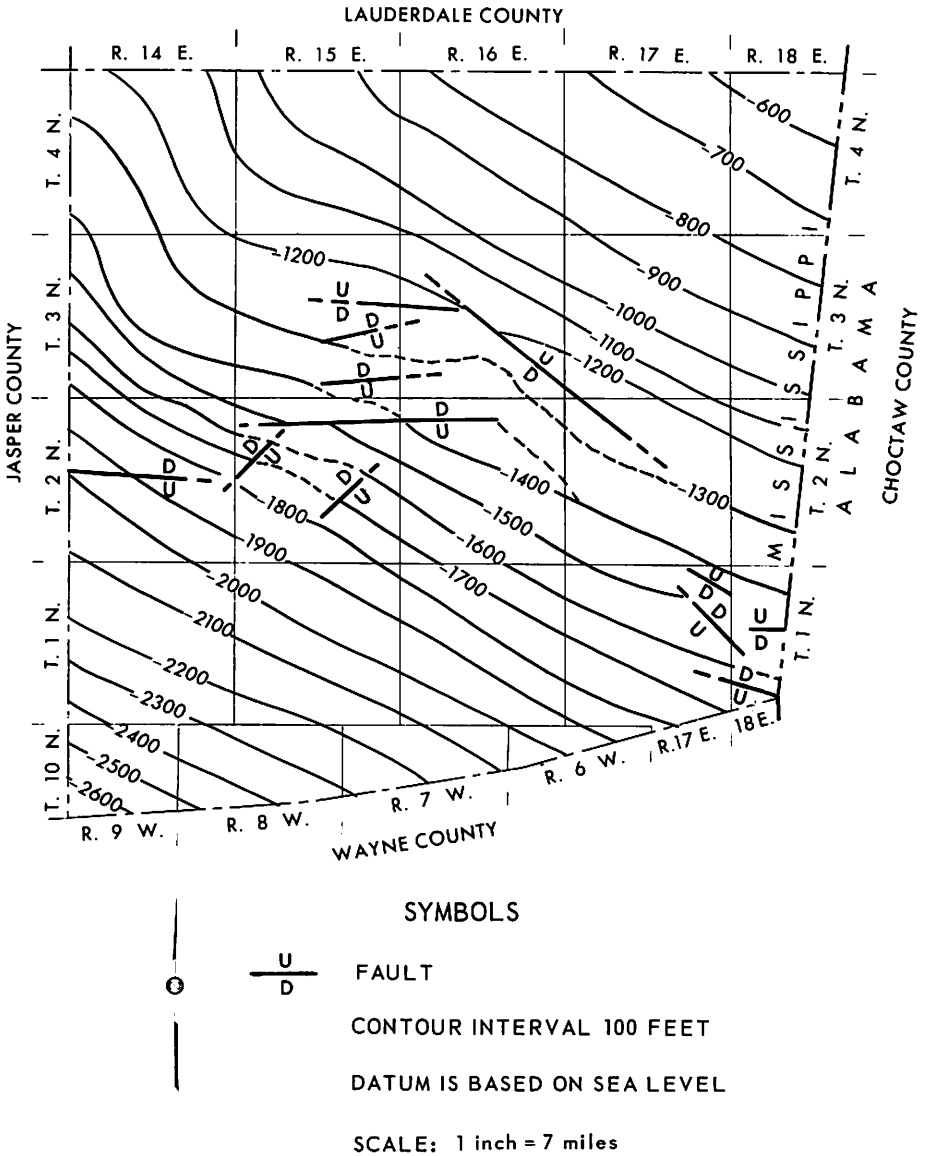

Figure 4—Configuration of the base of the Lower Wilcox in Clarke County, Mississippi.

TABLE 5

SUMMARY OF PUMPING TESTS IN CLARKE COUNTY, MISSISSIPPI

WELL NO.	OWNER	DEPTH (FEET)	AQUIFER	AQUIFER THICKNESS (FEET)	SCREEN LENGTH (FEET)	PUMP. PERIOD (HOURS)	TEST YIELD (GPM)	SPEC. CAPACITY GPM/FEET 1-DAY	TRANSMISSIBILITY GPD/FEET	PERMEABILITY GPD/FT2	TRANSMISSIVITY FT2/D	HYDR. CONDUCTIVITY FT/D
A1	Southern Natural Gas Company Well #2	1,355	WLCX		40	2	380	18	50,000		6,600	
*B1	Harmony Water Association Sandy Basin #1	378	MUWX		40				13,600			
G1	City of Quitman Well #2	1,869	WLCX		100	2	219		172,000			
*G2	Town of Stonewall	1,597	WLCX		30				30,000			
H11	East Quitman Water Association	320	KOSC	45	40	1	230	11	30,000	660	4,000	89
L3	Town of Pachuta	843	MUWX	62	40	119	55	.8	14,000	220	1,600	30
M1	De Soto Water Association	245	KOSC	58	50	6	119	1.1	25,000	43	330	5
M2	Harmony Water Association Well #2	306	KOSC	100	40	4	218	8.1	27,000	270		
M3	City of Quitman Ind. Pk. Well	1,934	WLCX	140	90	2	880	40	120,000		16,000	
R1	Town of Shubuta	208	CCKF	20	20	1	60	.4	4,000	200	530	26
*R4	Hiwanee Water Association	2,368	WLCX		70		448		70,000			
S1	Theadville Water Association	169	CCKF	48	40	7	106	4.1	11,000	220	1,400	30

* Estimated Transmissibility

Iron concentrations in water produced from the Wilcox outcrop area may exceed 0.3 mg/l. Immediately downdip of the recharge area, iron concentrations in the Wilcox water are usually less than 0.3 mg/l. Further downdip in southern Clarke County, the iron concentrations in the Wilcox water decrease to less than 0.2 mg/l.

Meridian Sand Member

The Meridian Sand Member is the lowermost unit in the Tallahatta Formation. The Meridian Sand is overlain by the undifferentiated Tallahatta Formation and is underlain by and hydraulically connected with upper Wilcox aquifers (Fig. 5).

Boswell (1976) indicates that the Meridian aquifer supplies two municipal and one rural water association with 200,000 gallons of ground water per day. Wells completed in the Meridian are from less than 200 feet deep in northwestern Clarke County to more than 950 feet in the southern parts of the county (Tables 1 and 3). Transmissibilities for Meridian aquifers will average 15,000 gpd/ft (Table 5). Individual sand thicknesses of the Meridian aquifers in Clarke County are extremely variable, but average 45 feet. Static water levels for Meridian wells are from less than 100 feet to more than 400 feet above mean sea level. Yields approaching 200 gpm from Meridian aquifers are possible, but most wells yield less than 100 gpm (Table 1).

Water produced from Meridian aquifers in Clarke County is soft and of the sodium bicarbonate type. Water movement within the Meridian sands is downdip to the southwest. Total dissolved solids in Meridian water are as low as 92 mg/l, but tend to increase downdip to as high as 419 mg/l. Excess color is a problem in the deeper Meridian aquifers, and can be as high as 200 units (Table 2).

Water produced from the Meridian aquifers has a pH of between 6.8 and 9.0. The lower pH values are present in water produced from shallow Meridian wells located 10 to 20 miles downdip of its recharge area. Further downdip to the southwest in Clarke County, the pH of Meridian water increases to a maximum of 9.0. Iron concentrations in Meridian water can be as high as 0.3 mg/l in northern Clarke County, but gradually decrease downdip to the southwest to 0.2 mg/l or less in the southern parts of the county.

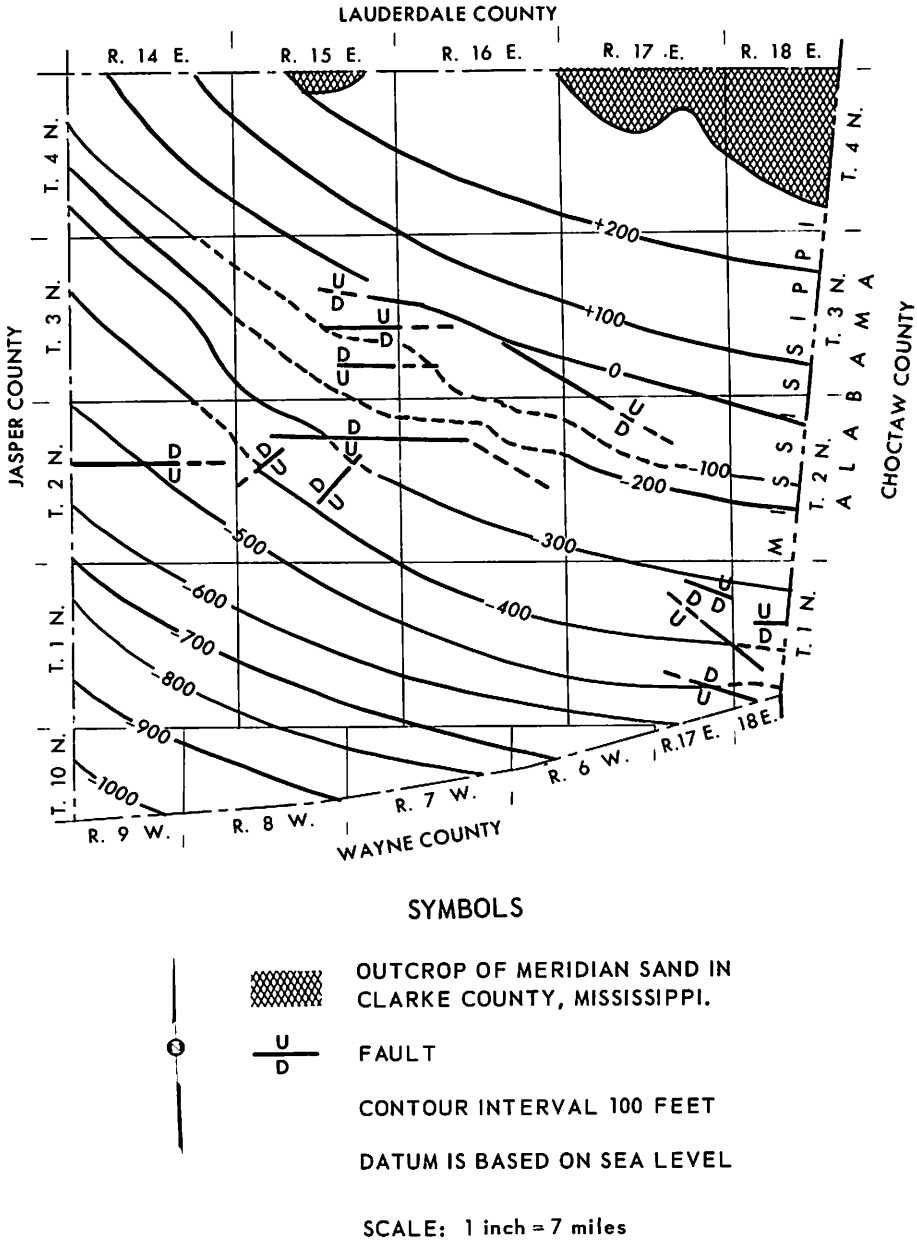

Figure 5–Configuration of the base of the Meridian Sand in Clarke Couhty, Mississippi.

Kosciusko Formation

The Kosciusko crops out in an irregular arc across the northern half of Clarke County (Fig. 6). It is underlain by the Zilpha Clay and overlain by the Cook Mountain Formation. Neither the Zilpha Clay nor the Cook Mountain are aquifers, and both are easily identified in well cuttings. Near the Alabama-Mississippi state line in Clarke County the Kosciusko is 100 feet thick; the formation thickens downdip to the southwest to nearly 200 feet in Smith County. Newcome (1976) and Payne (1968) indicate that unequal down-warping of the coastal plain under the weight of overlying sediments is responsible for the regional southwestward dip of the Kosciusko in Mississippi.

The Kosciusko aquifers in Clarke County are composed of rounded, very fine- to coarse-grained quartz sand. Water movement within the Kosciusko is to the southwest. Kosciusko sands are well sorted and thus should have high permeability and transmissibility. Transmissibilities for the Kosciusko aquifers are between 2500 to 27,000 gpd/ft (Table 5). The Koscisuko was deposited under marginal deltaic conditions, which accounts for the irregular sand thickness and variable transmissibilities.

Callahan (1975) states that the Kosciusko aquifers in Clarke County supply four rural and three municipal water associations with over 322,000 gpd. Wells completed in the Kosciusko are from 69 feet deep in northern Clarke County (Sec. 22, T.4 N., R.15 E.) to 597 feet deep in southern Clarke County (Sec. 25, T.1 N., R.16 E.). Static water levels for these Kosciusko wells are from 86 feet above sea level to more than 400 feet above sea level. Yields for these wells are as large as 600 gpm, but most wells yield between 10 to 100 gpm. Kosciusko wells located in areas of lower elevations will have enough hydrostatic head to flow several gallons per minute.

Wells completed in the Kosciusko aquifers in Clarke County produce water of the sodium bicarbonate type. Wells completed in the outcrop area in Clarke County may have iron concentrations in excess of 0.3 mg/l. Ten to twenty miles downdip of the outcrop area the iron concentrations in Kosciusko water decrease to less than 0.3 mg/l. Further downdip in northern Wayne County, the Kosciusko is not a desirable ground-water source due to excess iron, color, and high total dissolved solids.

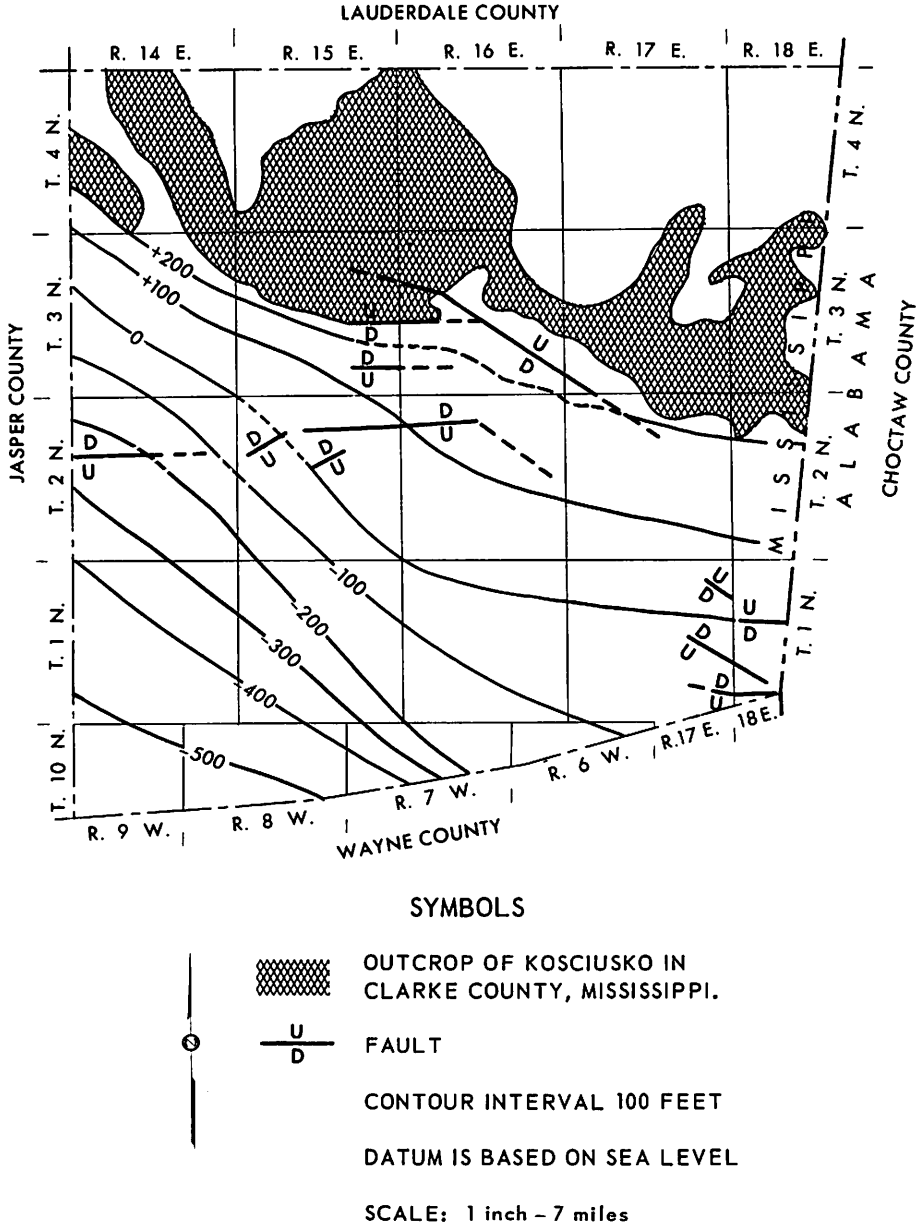

Figure 6–Configuration of the base of the Kosciusko Formation in Clarke County, Mississippi.

Kosciusko water in Clarke County is soft to slightly hard with a pH between 5.9 and 8.6. Total dissolved solids are generally less than 100 mg/l in northern Clarke County, but increase downdip to more than 700 mg/l. Excess color is a problem in Kosciusko water. One Kosciusko well in southern Clarke County (Sec. 4, T.10 N., R.7 W.) produces water with a color index of 200 units and total dissolved solids of 741 mg/l.

The Kosciusko Formation as a ground-water source is shallower than the Wilcox aquifers, and produces better quality water than the Cockfield aquifers, and is therefore the most utilized ground-water source in Clarke County. Kosciusko water is generally of good quality for most uses after some treatment. High concentrations of color and iron make treatment mandatory for public or industrial water supplies. Because of its stratigraphic position, the Kosciusko is an excellent source for rural self-supplied wells, even though it may need treatment for excess iron and color concentrations. Heavy pumpage from municipal, industrial, and rural self-supplied wells has caused a 0.3 foot per year decline in the static water level in Kosciusko wells in Clarke County.

Cockfield Formation

In Clarke County the Cockfield Formation is overlain by the Jackson Group and underlain by the Cook Mountain Formation. The Cook Mountain Formation and the Jackson Group act as confining beds for the Cockfield aquifers and thus produce artesian conditions. The Cockfield crops out in central Clarke County and dips to the southwest at 40 to 50 feet per mile. The formation is composed of fine- to medium-grained quartz sands, carbonaceous clays, and thin seams of lignite (Fig. 7). Water movement within the Cockfield is downdip to the southwest. Spiers (1977) indicates the Cockfield aquifers supply one municipal, two public, and numerous rural self-supplied wells in central and southern Clarke County with an estimated 250,000 gallons of ground water per day. Individual sand thicknesses within the Cockfield are erratic, but are usually less than 50 feet. Many wells completed in the Cockfield are less than 200 feet deep, and wells as shallow as 90 feet are reported in south-central Clarke County (Sec. 16, T.2 N., R.14 E.). Static water levels for Cockfield wells are from 30 feet to 257 feet above sea level. These wells generally yield less than 100 gpm and transmissibilities vary from 4,000 to 11,000 gpd/ft (Table 5).

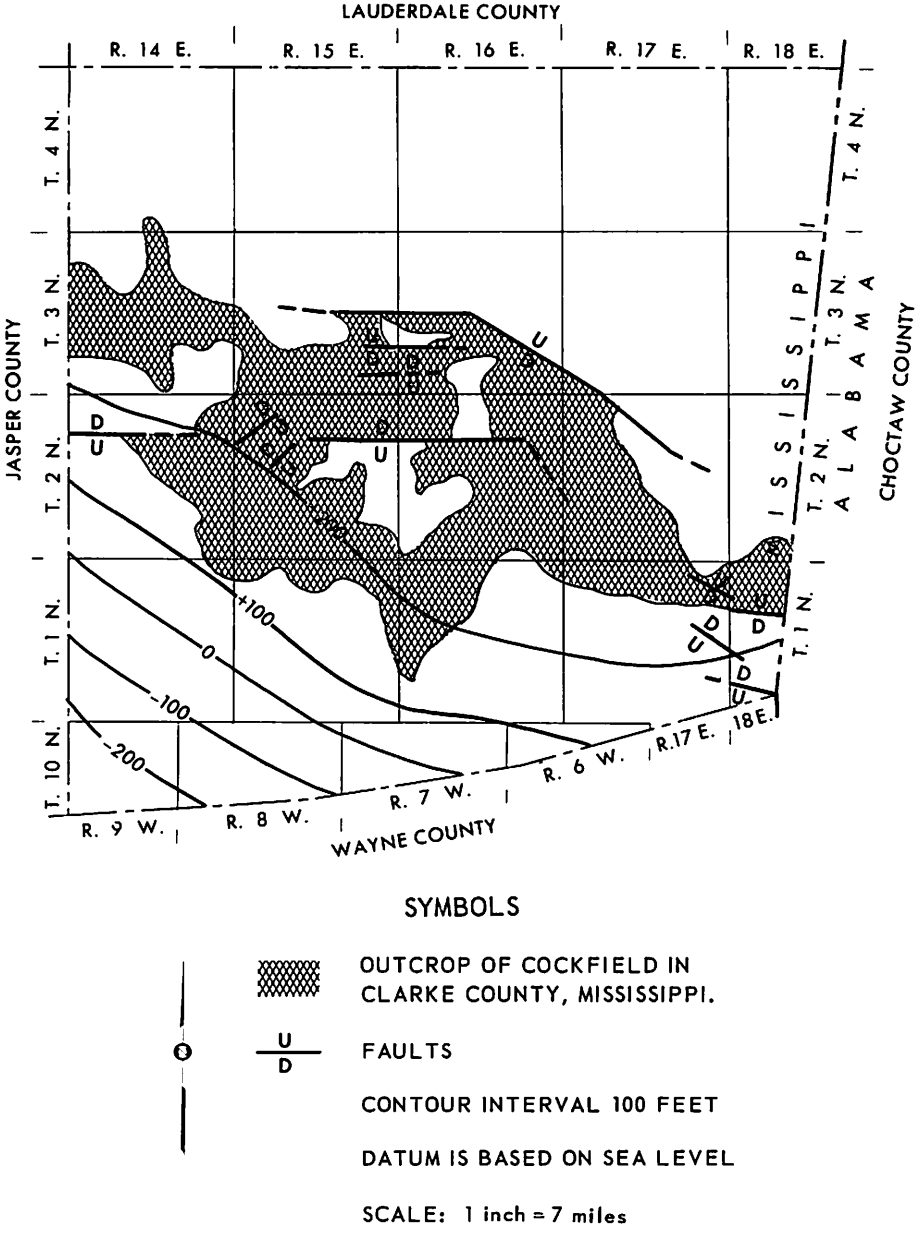

Figure 7–Configuration of the base of the Cockfield Formation in Clarke County, Mississippi.

Water produced from the Cockfield aquifers in Clarke County is of the sodium bicarbonate type. Hardness is from 3 mg/l to 73 mg/l, indicating that Cockfield water is soft to moderately hard. The pH of Cockfield water is between 5.9 and 8.3. The lower pH values are found in water produced from wells in the Cockfield's outcrop area in central Clarke County.

Iron concentrations in Cockfield water are also highest in the outcrop area, but the concentrations tend to decrease downdip to less than 0.3 mg/l. Total dissolved solids are generally less than 200 mg/l in the aquifer's outcrop area, but increase downdip in southern Clarke County to more than 700 mg/l. Excess color is a common problem in Cockfield water due to the presence of lignite interbedded with the Cockfield sands. This lignite coming into contact with water moving through the Cockfield imparts an organic color to the water. One Cockfield well in southern Clarke County (Sec. 4, T.10 N., R.7 W.) produces water with a color index in excess of 300 units.

The Cockfield aquifers are the shallowest dependable source of ground water in the southern third of Clarke County. Cockfield water may need treatment for excess iron, color, and total dissolved solids, but the large quantities of ground water at shallow depths make it a possible source for rural self-supplied wells.

Jackson Group: Cocoa Sand

The Cocoa Sand is the only member of the Jackson Group that is sandy enough to yield a small amount of ground water. The Cocoa Sand is discontinuous in Clarke County, thinning from a maximum thickness of 30 feet in southeastern Clarke County to less than one foot in thickness northeast of Shubuta.

Because of its restricted occurrence and limited development, the Cocoa Sand is not a potential ground-water source in Clarke County. No wells are reported to be completed in this member to date, so no quality or production data are presently available. Maximum development of the Cocoa Sand is in southeastern Clarke County. In this area, a sand thickness of 15 to 20 feet could possibly be found which could support a small yield rural self-supplied well.

Vicksburg Group

The Red Bluff and Mint Spring Formations are present in a limited area in extreme southwestern Clarke County (Fig. 8). The upper parts of the Red Bluff and Mint Spring Formations contain sand development up to 15 feet in thickness, which could supply rural self-supplied wells having yields of up to 8 gpm. Gandl (1979) states that the sand content of the Red Bluff decreases to the southeast in Clarke County, and May and Baughman (1974) indicate the formation is not an aquifer in Wayne County. No wells in Clarke County are reported to be completed in the Mint Spring, but some reported Red Bluff wells may actually be completed in Mint Spring sands.

Only three wells in southwestern Clarke County are completed in the Red Bluff Formation. These wells are from 110 to 280 feet in depth and have static water levels from 230 to 400 feet above sea level. No pumping test data are available, but an estimated transmissibility of 3,000 gpd/ft was calculated for the Red Bluff Formation by using a permeability of 300 gpd/ft and an aquifer thickness of ten feet.

Water produced from the Red Bluff aquifers is moderately hard and of the sodium bicarbonate type (Table 1). Iron concentrations are commonly around 0.3 mg/l and total dissolved solids are between 300 to 400 mg/l. Red Bluff water contains up to 0.2 mg/l of fluoride, and the color index is below 20 units.

Because of limited potential and occurrence of the Red Bluff and Mint Spring aquifers, they are not utilized to a large extent. Very limited yield, erratic sand occurrence, and excess hardness severely restrict these aquifers as a source of ground water in Clarke County.

Catahoula Formation

The outcrop area of the Catahoula Formation is limited to southwest Clarke County (Fig. 9). It is composed of fine- to medium-grained sands, silts, and clays and is approximately 50 feet thick. Individual sand thickness can be up to 40 feet. Newcome (1975) states that the Catahoula aquifers normally have greater water-transmitting capacity than the older formations of Mississippi.

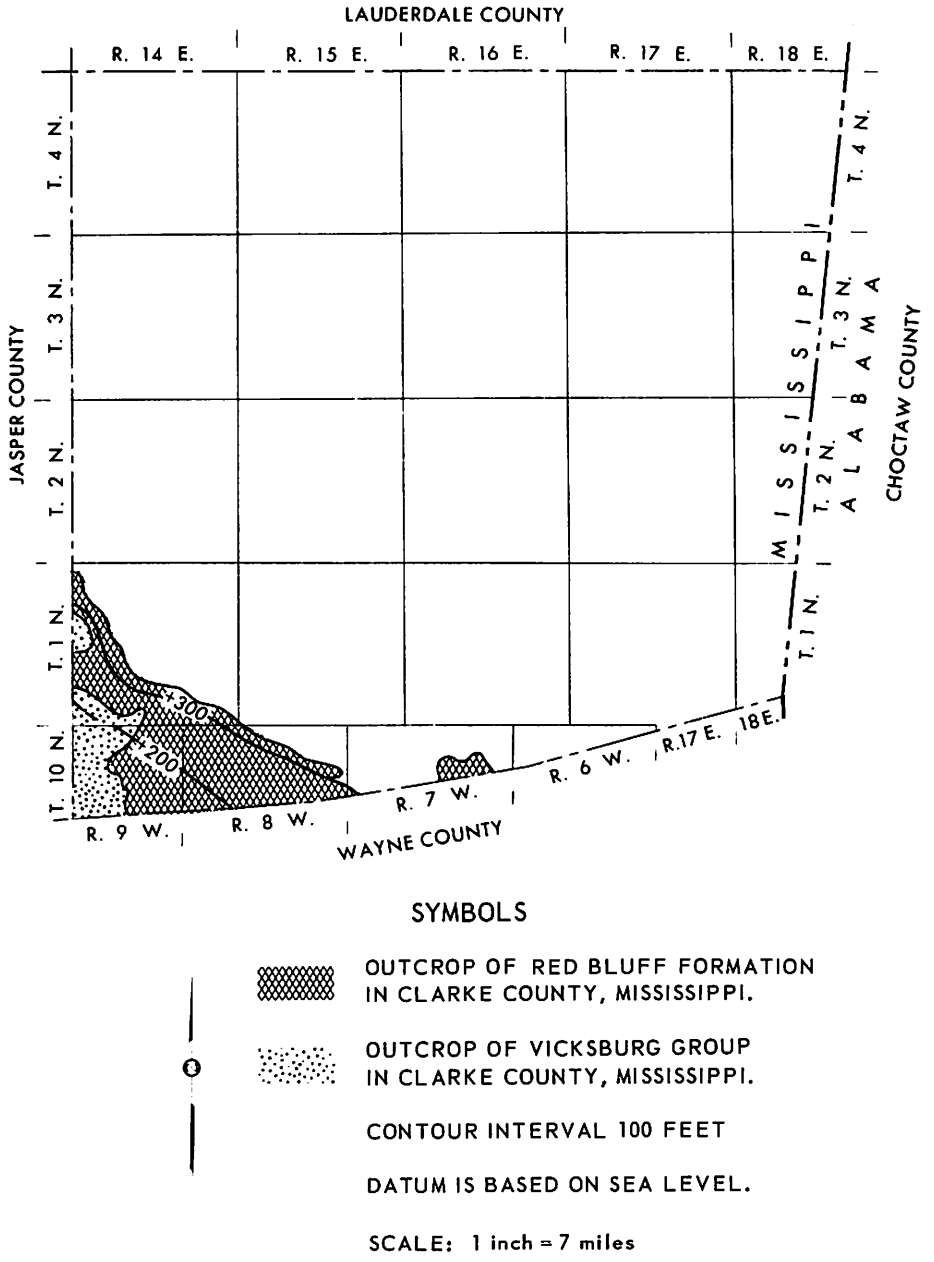

Figure 8—Configuration of the base of the Vicksburg Group and the Red Bluff Formation in Clarke County, Mississippi.

Wells completed in the Catahoula Formation in Clarke County are generally less than 100 feet deep. These Catahoula wells yield 5 to 7 gpm to small rural self-supplied wells.

Water produced from the Catahoula aquifers is soft and of the sodium bicarbonate type. Water from the Catahoula aquifers has a pH of approximately 6.4, iron concentrations of 0.1 to 0.3 mg/l, and up to 0.2 mg/l of fluoride (Table 1). This low pH "acid water" will over a period of years have a corrosive effect upon metal pipes, tanks, and fixtures.

The Catahoula Formation is limited as a ground-water source in Clarke County because of its restricted presence. Catahoula aquifers can yield 5 to 7 gpm of fair quality water to properly constructed wells. Because of this restricted occurrence, low pH, and limited yield, the Catahoula aquifers are not recommended as reliable ground-water sources in Clarke County.

Citronelle Formation

The Citronelle Formation is a minor aquifer capping the higher elevations in southwestern Clarke County (Fig. 9). Boswell (1979) states that the Citronelle Formation is the shallowest significant source of ground water in southern Mississippi. The formation is extremely erratic, but a maximum thickness of 120 feet was observed in the Mississippi Geological Survey Test Hole AN-12 (Sec. 2, T.10 N., R.9 W.). Recharge and the static water level of the Citronelle Formation will depend upon precipitation, since the formation is a water-table aquifer.

Water from the Citronelle aquifers is of very poor quality, with hardness often greater than 200 mg/l and iron concentrations above 0.3 mg/l. A shallow well in southwestern Clarke County (Sec. 32, T.1 N., R.14 E.) is the only Citronelle well reported in Clarke County. Fluctuations in water levels are seasonal in the Citronelle, thus restricting the quantity of ground water available.

Terrace Deposits and Alluvium

The terrace deposits in Clarke County are present at lower elevations than the Citronelle Formation. These deposits are restricted to the western and southwestern parts of the county where they consist of up to 44 feet of poorly sorted, fine- to coarse-grained sand and pebble-size gravels. The alluvial deposits in the

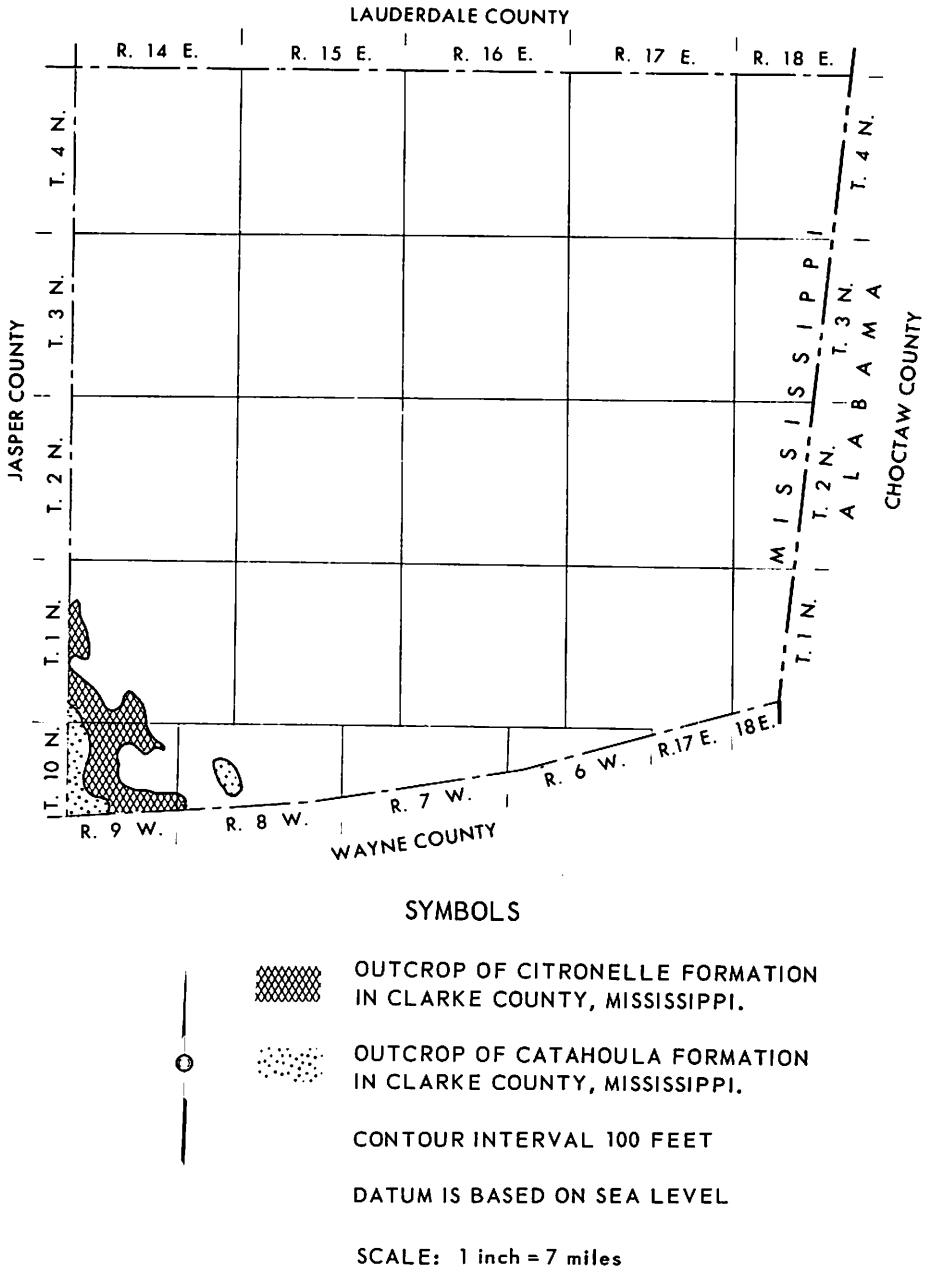

Figure 9–Configuration of the base of the Catahoula and Citronelle Formations in Clarke County, Mississippi.

county consist of up to 34 feet of sands, silts, gravels, and unconsolidated detrital material deposited during Recent geological time in the flood plains of rivers and streams. Neither the terrace nor alluvial deposits are continuous enough for development as a ground-water source in Clarke County. Both deposits are water-table aquifers; static water levels vary with precipitation and slope in the direction of surface drainage.

Water produced from both aquifers is of very poor quality, with a low pH, excess hardness, and high iron concentrations. Only a few driven wells constructed in Enterprise, Mississippi, after the turn of the 20th century are completed in these deposits (Table 1).

Ground Water Conclusions

Present ground-water usage in Clarke County accounts for only a small portion of the total amount of ground water available. Ground-water development has been limited by water quality and by depth to the various aquifers. The potential for ground-water development is excellent since most areas of Clarke County are underlain by at least two fresh-water, artesian aquifers than can yield large quantities of ground water to properly constructed wells.

Ground water is available from aquifers within the Wilcox Group, Meridian Sand, Tallahatta Formation, Winona Sand, Kosciusko (Sparta) Formation, Cockfield Formation, Cocoa Sand, Red Bluff Formation, Citronelle Formation, and terrace and alluvial deposits. Wells completed in these aquifers vary from 69 feet to 2386 feet in depth, and yields up to 500 gpm were recorded. Static water level decline is small in Clarke County, due to the lack of large-scale municipal and industrial development. The average rate of decline of 0.3 ft/year will increase as ground-water development in the county increases.

The ground water in Clarke County is of good quality and can be used for most purposes without treatment. Water quality problems include iron concentrations above 0.3 mg/l, total dissolved solids greater than 500 mg/l, high color index, hardness approaching 200 mg/l, and low pH. Treatment for these water quality problems can be expensive, so some aquifers in the Cockfield are utilized little because better quality ground water in larger quantities can be found in the deeper Kosciusko and Wilcox aquifers.

SURFACE WATER

Introduction

Water standing on the ground's surface or running off into lakes and streams is known as surface water. Surface water can be used to meet small demands where adequate ground water is not available or is not of suitable quality. In general, surface water requires more extensive treatments than ground water. The choice between the two supplies is influenced by the economics of the treatments required.

The surface water in Clarke County is composed of varying proportions of direct runoff and ground-water discharge. Stream discharge in the county during low flow consists of ground water discharging into the streams, and during high flow the runoff discharging directly into the rivers and streams.

Most rivers and streams in Clarke County have low flow during periods of dry weather. Low flow is the greatest problem in developing a surface-water source. Streams located in Clarke County can have flow as low as zero or near zero during part of the year.

The chemical quality of the surface water in Clarke County is derived from rocks and minerals or man-made pollutants with which the surface water has been in contact. The composition of pollutants and mineral solubility is responsible for the variation in chemical quality of the surface water in Clarke County. Dissolved constituents such as total dissolved solids, color, and iron concentrations are lowest in the surface water during periods of high flow, and highest when the streamflow is derived mostly from ground water.

Drainage

Clarke County lies within the Pascagoula and Tombigbee River drainage basins (Fig. 6, Gilliland). Most of the county lies within the Pascagoula River drainage basin, but a small portion of northeastern Clarke County is drained by Pocolechetto Creek, Okatuppa Creek, and Little Okatuppa Creek, which flow into the Tombigbee River drainage basin in Choctaw County, Alabama.

The Chickasawhay River and its major tributaries Gordon Creek, Souinlovey Creek, Pachuta Creek, Shubuta Creek, Garland

Creek, Archusa Creek, and Fallen Creek drain the entire western half of Clarke County. The Chickasawhay River is formed by the confluence of the Chunky and Okatibbee Rivers one-half mile north of Enterprise. This perennial river, the largest in the county, flows essentially north to south across the length of the county.

Bucatunna Creek drains 330 square miles and flows to the south across the entire length of eastern Clarke County. Bucatunna Creek and its major tributaries Hurricane Creek, Long Creek, Tallabogue Creek, Double Creek, Cedar Creek, Brush Creek, and Rocky Creek drain the eastern parts of the county.

Surface-Water Availability

Surface-water sources in Clarke County can be grouped into perennial rivers and streams, impounded reservoirs, and lakes. Perennial rivers include the Chickasawhay River and Bucatunna Creek, which could be used as a surface-water source without impoundment provided the maximum demand during the critical season does not exceed minimum stream flow. If maximum demand for surface water exceeds minimum river and stream flow, construction of an impounded water source such as Archusa Creek Water Park will be required to store water during periods of excess supply for use during periods of increased demand.

Water quality of the Chickasawhay River is influenced by seasonal variations, changes in the stream flow, and man-made pollution. A pH of 5.5 was recorded in the Chickasawhay River in August 1955, and a pH as high as 6.7 was recorded in May of 1964 (Table 6).

Iron concentrations in the Chickasawhay River were as high as 3.3 mg/l in May 1967, but are generally less than 0.1 mg/l. Total dissolved solids in the river are generally less than 100 mg/l and the color index is a maximum of 40 units (Table 6).

The next largest available sources of surface water in Clarke County are Bucatunna and Souinlovey Creeks. Souinlovey Creek has a drainage area of 244 square miles and Bucatunna Creek drains approximately 330 square miles. Annual low flow for these two streams is less than 10 cubic feet per second (cfs), which indicates that the minimum flow for these two streams is not sufficient to serve as a reliable surface-water source without impoundment (Table 7).

TABLE 6

CHEMICAL ANALYSES OF WATER FROM SELECTED STREAMS IN CLARKE COUNTY, MISSISSIPPI

(Constituents in Milligrams Per Liter)

Date of Collection	Discharge (cfs)	Silica (SiO)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO)	Parts Per Million	Dissolved Solids (Residue at 180° C) Tons Per Acre-Foot	Dissolved Solids (Residue at 180° C) Tons Per Day	Hardness as $CaCO_3$ Calcium, Magnesium	Hardness as $CaCO_3$ Noncarbonate	Sodium Adsorption Ratio	Specific Conductance (Micromhos at 25° C)	pH	Color
2 - 4770 CHICKASAWHAY RIVER AT ENTERPRISE, MISSISSIPPI *																					
January 23, 1964	270	15	0.00	6.8	2.7	6.7	1.8	18	16.0	7.8	0.2	1.1	67	0.09	48.8	28	13	0.5	99	6.2	10
May 26, 1964	246	16	.08	3.7	4.1	6.4	1.7	28	9.8	5.7	.1	0.2	62	.08	41.2	26	3	.5	76	6.7	20
March 8, 1965	1,210	14	.13	5.2	0.5	3.2	1.0	13	7.2	4.1	.0	.2	42	.06	137	15	4	.4	55	5.6	20
June 21, 1965	146	13	.00	7.5	1.8	6.2	1.8	24	10.0	6.5	.5	0.7	60	.08	23.7	26	6	.5	92	5.7	10
August 24, 1965	298	10	.01	5.4	1.4	4.4	2.3	18	11.0	3.8	.2	0.2	62	.08	49.9	20	5	.4	82	5.5	15
October 18, 1966	135	15	.01	6.8	2.3	9.0	3.2	25	10.0	13.0	.6	0.2	83	.11	30.2	26	6	.8	118	5.9	10
November 30, 1966	168	13	.31	5.9	2.3	6.2	2.4	26	8.4	6.6	.2	2.5	79	.11	35.7	24	3	.5	91	6.2	20
January 4, 1967	260	14	.16	4.5	1.6	4.0	1.9	13	9.8	5.0	.1	0.5	62	.08	43.5	18	7	.4	63	6.1	40
February 9, 1967	372	10	.10	4.2	1.1	3.5	1.4	10	8.2	5.1	.1	0.3	36	.05	36.1	15	7	.4	55	5.5	20
March 3, 1967	238	14	.11	5.9	0.8	4.6	1.2	16	7.2	5.9	.1	0.1	58	.08	37.2	18	5	.5	67	5.9	20
April 12, 1967	230	13	.07	8.0	2.4	6.6	2.0	25	9.6	6.9	.5	2.4	65	.09	40.3	30	9	.5	95	6.0	15
May 3, 1967	1,610	11	3.30	4.9	0.9	3.8	2.6	18	8.2	3.5	.1	0.7	58	.08	252	16	1	.4	76	6.1	40
June 1, 1967	421	14	.02	7.0	1.6	6.9	1.7	21	8.0	6.5	.8	1.6	63	.09	71.5	24	7	.6	87	6.5	15
August 21, 1967	108	14	.12	9.0	1.8	11.0	2.9	30	12.0	12.0	.7	2.3	87	.12	25.3	30	5	.9	122	6.3	20
October 25, 1967	72	11	.09	7.6	2.2	8.5	3.3	26	11.0	8.6	.8	0.1	75			28	7		107	6.0	15
June 11, 1969	162	12	.35	8.4	2.2	9.3	2.6	38	9.8	6.1	.2	2.5	84			30	0		115	6.4	15
2 - 4772 ARCHUSA CREEK AT QUITMAN, MISSISSIPPI *																					
October 18, 1966	390	10.0	0.09	1.4	0.7	2.9	1.0	11	0.4	2.6	0.0	0.2	31	0.04	32.60	6	0	0.5	30	5.7	15
December 1, 1966	40	10.0	.18	1.1	.6	2.1	1.0	10	1.6	2.6	.0	.2	30	.04	3.22	5	0	.4	28	6.2	20
January 4, 1967	630	10.0	.12	2.5	.4	2.0	0.8	9	2.7	3.0	.0	.3	33	.04	56.00	8	1	.3	29	6.0	40
February 9, 1967	73	8.9	.15	2.4	.6	2.1	0.1	7	3.7	3.2	.0	.3	27	.04	5.31	8	3	.3	30	5.8	20
March 3, 1967	51	9.1	.15	3.0	.6	2.3	0.5	8	5.6	3.3	.0	.2	30	.04	4.12	10	3	.3	30	6.0	15
April 12, 1967	35	10.0	.21	1.9	.7	1.7	0.5	13	0.2	2.0	.0	.6	32	.04	2.58	8	0	.3	33	6.5	30
May 3, 1967	58	9.4	.31	2.0	.7	1.4	0.6	8	2.2	1.6	.0	.6	32	.04	5.00	8	1	.2	29	6.0	40
June 1, 1967	58	8.6	.12	4.0	.0	2.4	0.5	9	1.4	2.9	.0	.4	33	.04	5.15	10	3	.3	30	6.4	20
August 21, 1967	20	10.0	.21	7.0	1.0	2.2	0.1	10	0.0	3.1	.1	.4	35	.05	1.87	9	1	.3	28	6.0	30
2 - 4773.3 SHUBUTA CREEK NEAR SHUBUTA, MISSISSIPPI *																					
October 18, 1966	9.5	7.1	0.03	6.2	0.6	2.0	1.0	20	1.2	3.5	0.0	0.2	34	0.05	0.86	18	2	0.2	43	6.0	10
December 1, 1966	19.0	7.6	.15	3.3	.6	2.0	1.1	18	1.8	2.2	.0	.2	36	.05	1.83	11	0	.3	42	6.4	15
January 4, 1967	9.0	7.9	.16	7.5	.8	2.5	1.0	21	7.6	3.7	.0	.2	51	.07	1.22	22	5	.2	61	6.7	50
February 9, 1967	53.0	6.6	.16	7.5	.8	2.4	1.7	17	7.8	3.5	.1	.5	48	.07	6.85	22	8	.2	59	6.0	40
March 3, 1967	12.0	6.3	.06	8.6	1.1	2.6	1.0	23	6.2	4.6	.1	.0	55	.07	1.77	26	7	.2	65	6.5	20
April 12, 1967	8.0	5.4	.13	8.9	1.0	2.3	0.7	28	1.6	3.5	.1	.5	49	.07	1.04	26	3	.2	64	6.2	15
May 3, 1967	37.0	8.1	.32	7.0	.9	2.0	0.9	23	4.0	2.9	.0	.7	47	.06	4.68	21	2	.2	59	6.5	40
June 1, 1967	41.7	7.1	.14	9.9	.1	2.5	0.6	28	1.8	2.8	.1	.1	43	.06	4.75	25	2	.2	62	6.8	20
August 21, 1967	7.0	7.4	.24	7.9	.6	1.9	0.3	29	0.4	2.7	.1	.2	44	.06	.82	22	0	.2	57	6.4	50
October 25, 1967	6.8	8.7	.10	5.5	.8	2.0	1.2	19	1.4	3.0	.0	.1	36			17	1		44	6.2	20

* RECORDS FROM U. S. GEOLOGICAL SURVEY
WATER RESOURCES DATA FOR MISSISSIPPI 1964 - 1969

TABLE 7

STREAM GAGING STATION LOCATIONS IN CLARKE COUNTY, MISSISSIPPI

LOCATION	STATION NO.	STATION NAME & LOCATION	DRAINAGE AREA (SQUARE MILES)	PERIOD OF RECORD (YEARS)	MINIMUM FLOW IN C.F.S. (7-DAY AVERAGE) AND YEAR	MAXIMUM FLOW IN C.F.S. (7-DAY AVERAGE) AND YEAR
1	2 - 4770.00	Chickasawhay River at Enterprise SE/4 NW/4 Section 24, T 4 N, R 14 E	913	1938 - 68	18 (1954)	61,700 (1961)
2	2 - 4773.50	Chickasawhay River at Shubuta on section line between Sections 9 & 10, T 10 N, R 7 W	1,460	1904 - 64	57	86,000 (1961)
3	2 - 4771.9	Chickasawhay River at U. S. Highway 45, 2 miles South of Quitman	1,210	1938 - 68	24	61,100 (1900)
4	2 - 4777	Buckatunna Creek at Highway 18, ½ mile East of Sykes	120	1938 - 68	.1	15,800 (1964)
5	2 - 4779	Buckatunna Creek near Carmichael	330	1939 - 65	6.9	
6	2 - 4771	Souinlovey Creek, 1.7 miles North of Pachuta	174	1938 - 68	1.1	20,000 (1961)
7	2 - 4771.8	Souinlovey Creek near Quitman	244	1938 - 68	2.7	
8	2 - 4773.3	Shubuta Creek, 1.5 miles Northwest of Shubuta	95	1938 - 68	5.5	15,000 (1964)
9	2 - 4771.5	Pachuta Creek at U. S. Highway 11 in Pachuta	23	1938 - 68	.7	7,200 (1964)
10	2 - 4778	Long Creek near Quitman	75	1938 - 68	.5	9,400 (1964)
11	2 - 4757	Chunky Creek at U. S. Highway 11, 1 mile North of Enterprise	458	1954 - 68		32,500

Selection of a site for an impounded reservoir is based upon geological conditions, topography, and total accumulated yield of the streams to be impounded. The single most important item in selecting a stream for impoundment is that the total accumulated yield of the impounded stream will exceed maximum water demand. Archusa Creek Water Park, one-half mile east of Quitman, is an impounded lake used for recreational purposes. Archusa Lake, having a surface area of 650 acres, is the largest lake in the county, and could serve as an emergency water supply with a minimum of treatment. This impoundment can regulate a small amount of streamflow, but is designed for recreational use, not flood control.

Lakes present in Clarke County include Coker Lake, Lake Bounds, and Lake Waukaway. These lakes are relatively small, generally less than five acres surface area, and all are used for recreational purposes. Lake Bounds is fed by a spring flowing 50,000 gallons per hour while Lake Waukaway is fed by a spring yielding 39,208 gallons per hour (Table 1 and Table 2). Both lakes have an annual temperature of 65°F, iron concentrations of 0.1 to 0.3 mg/l, and a pH of approximately 6.6. The lakes in Clarke County are small, and thus have limited water-supply potential.

Figure 10 shows the locations of the 27 surface-water samples collected for this investigation in Clarke County. The water samples were analyzed "in the field" with a Hach colorimeter to determine chemical and physical properties such as temperature, specific conductance, total dissolved solids, hardness, pH, and NaCl and Cl concentrations (Table 8).

In the streams in Clarke County the water is soft to moderately hard and has a color index of 10-50 units. The pH of the surface water will vary with the season and amount of streamflow, but it is generally between 5.5 and 6.8 (Table 8).

Unusual conditions such as droughts or flooding will alter water quality. Turbidity and color tend to increase during high streamflow. Total dissolved solids and silica are lowest during periods of high streamflow, and are highest when recharge to the streams is mainly from ground water (Tables 6 and 8).

Surface samples 24-27, located near the older oil-fields in Clarke County (Fig. 10), contain NaCl concentrations as high as 247

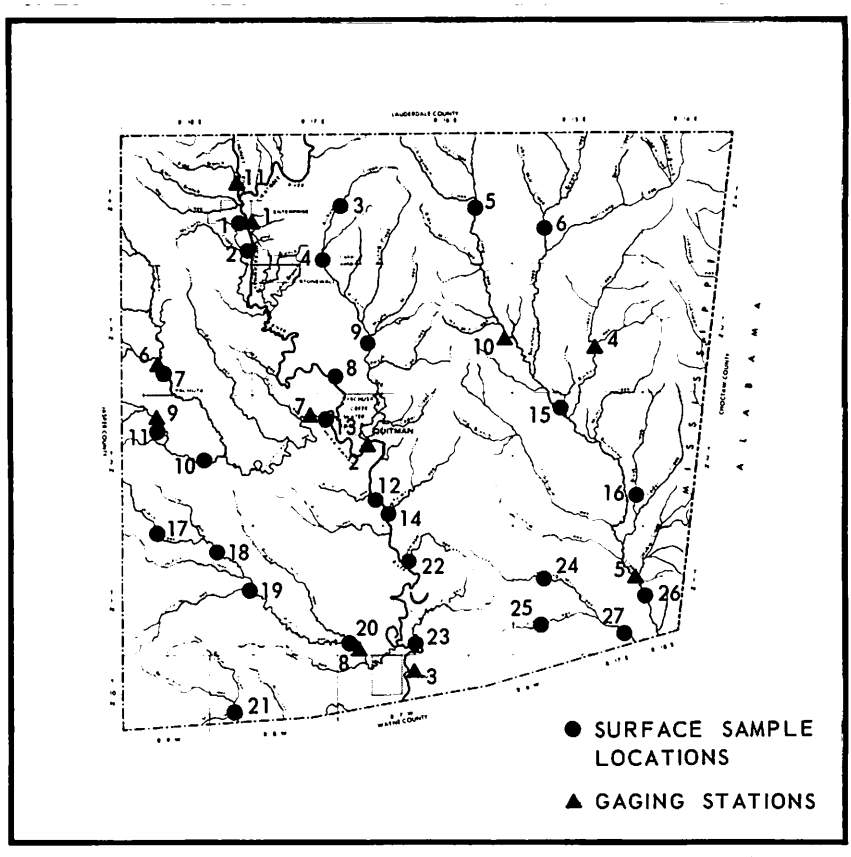

Figure 10.– Location of surface sample locations and gaging stations in Clarke County, Mississippi.

mg/l, Cl as high as 150 mg/l and total dissolved solids above 400 mg/l (Table 8). The analyses of these surface samples indicate oil-field brine pollution has entered streams near Junction City Field (Sec. 30, T.2 N., R.17 E.), West Langsdale Field (Sec. 26, T.1 N., R.17 E.), and Carmichael Field (Sec. 5, T.1 N., R.17 E.). Observations indicate this brine pollution has killed trees and other plants.

The primary cause of brine pollution of the surface water in Clarke County is the use of unlined salt-water evaporation pits. This salt water can seep or overflow from the pit, causing nearby

TABLE 8

SURFACE-WATER SAMPLE ANALYSES IN CLARKE COUNTY, MISSISSIPPI

LOCATION	DATE	TEMP. °F	TEMP. °C	SPEC. COND.	NaCL	CL	pH	HARDNESS	TOTAL DISSOLVED SOLIDS
1	4-8-78	62	16.7	40	25	15	7.0	51.3	25.0
	9-7-78	69		30	8.2	5	6.5	17.1	18.0
2	4-8-78	63	17.2	85	25	15	7.0	68.5	53.0
	9-9-78	70		55	12.4	7.5	6.6	17.1	34.6
3	4-8-78	63	17.2	43	25	15	6.7	102.6	27.0
	9-9-78	71		60	12.4	7.5	6.5	17.1	37.8
4	4-8-78	65	18.3	26	25	15	8.2	17.1	16.3
	9-9-78	71		24	8.2	5	6.0	0	15.1
5	4-8-78	62	16.7	30	25	15	6.7	17.1	18.9
	9-9-78	71		26	8.2	5	5.8	0	16.3
6	4-8-78	61	16.1	32	25	15	6.6	17.1	20.1
	9-9-78	71		28	12.4	7.5	5.9	0	17.6
7	4-8-78	62	16.7	95	25	15	7.4	51.3	59.8
	9-9-78	70		60	12.4	7.5	6.6	17.1	37.8
8	4-9-78	61	16.1	20	25	15	6.6	0	12.6
	9-10-78	71		24	8.2	5	6.5	0	15.1
9	4-11-78	60	15.6	34	25	15	6.7	17.1	21.4
	9-10-78	71		70	8.2	5	6.3	0	44.1
10	4-8-78	64	17.8	44	25	15	7.4	17.0	27.7
	9-10-78	71		34	8.2	5	6.2	0	21.4
11	4-8-78	62	16.7	16	25	15	6.8	17.1	10.0
	9-11-78	71		29	8.2	5	6.3	0	18.2
12	4-9-78	60	15.6	90	25	15	7.2	34.2	56.7
	9-10-78	70		54	8.2	5	6.9	17.1	34.0
13	4-9-78	71	21.7	60	25	15	6.5	34.2	37.8
	9-10-78	73		46	8.2	5	6.5	17.1	28.9
14	4-10-78	59	15.0	140	50	30.3	7.7	34.2	88.2
	9-10-78	72		150	57.7	35	7.6	34.2	94.5
15	4-10-78	60	15.6	32	25	15	6.5	17.1	20.1
	9-11-78	75		26	8.2	5	6.3	0	16.3
16	4-10-78	61	16.1	190	150	90.9	5.4	34.2	119.7
	9-11-78	72		70	33	20.0	6.3	0	88.2
17	4-9-78	59	15.0	65	25	15	7.3	17.1	40.9
	9-11-78	72		130	41.25	25	6.9	34.2	81.9
18	4-9-78	59	15.0	65	25	15	7.5	34.2	40.9
	9-11-78	71		58	8.2	5	7.5	17.1	36.5
19	4-9-78	59	15.0	75	37.5	22.7	7.2	34.2	47.2
	9-11-78	73		150	41.25	25	6.4	51.3	94.5
20	4-9-78	57	13.9	130	50	30.3	7.5	85.5	81.9
	9-11-78	70		150	16.5	10	7.5	68.4	94.5
21	4-9-78	60	15.6	85	37.5	22.7	7.6	34.2	53.5
	9-11-78	73		95	33	20	6.9	34.2	59.8
22	4-11-78	58	14.4	155	37.5	22.7	7.9	68.4	97.6
	9-11-78	72		115	16.5	10	7.3	51.3	72.4
23	4-9-78	65	18.3	90	37.5	22.7	7.0	34.1	56.7
	9-10-78	79		40	16.5	10	6.6	0	25.2
24	4-10-78	57	13.9	150	50	30.3	7.4	51.3	94.5
	9-10-78	72		380	49.5	50	6.5	34.2	239.4
25	4-10-78	60	15.6	65	50	30.3	6.6	17.1	40.9
	9-10-78	89		460	247.5	150	6.1	34.2	289.8
26	4-10-78	57	13.9	80	25	15	7.5	34.2	50.4
	9-10-78	71		78	16.5	10	6.8	34.2	49.1
27	4-10-78	59	600	350	212.1	212.1	5.6	68.4	220.5
	9-11-78	71	530	247.5	150	150	6.3	51.3	155.9

trees and plant life to be killed. The salt water can enter local drainages or the recharge area of fresh-water aquifers, causing

brine pollution of both ground and surface water.

Flooding

Listed in Table 7 is information recorded by the eleven stream gage stations located in Clarke County. This stream gaging network can provide partial and continuous records of maximum and minimum seven-day streamflow. All major rivers and streams in Clarke County may flood, so flood records must be considered before construction in or near a river's flood plain. Information including flood records, flood maps, flood frequency curves, and flood profiles is available at the United States Geological Survey, Water Resources, Jackson, Mississippi.

Wilson (1964, 1968) and Tharpe (1975) indicate that the greatest flooding in Clarke County occurred during February 1961, when the Chickasawhay River at Enterprise crested at 37.9 feet. The "great flood" of 1900 was probably of equal magnitude since floodmarks of 37.2 feet were reported at Enterprise. Future flooding along the Chunky River, Chickasawhay River, and Okatibbee Creek in Clarke County will be influenced by the operation of Okatibbee reservoir located in northern Lauderdale County. Part of the flood runoff from the headwaters of Okatibbee Creek can be retained by the reservoir and thus reduce flood peaks on the Chickasawhay River downstream at Enterprise, Quitman, De Soto, and Shubuta.

Surface Water Conclusions

Present surface-water usage is restricted to livestock watering, fish ponds, and recreation. Surface-water development potential is excellent since there are only restricted occurrences of man-made pollution in the county. The Chickasawhay River, the largest river in the county, is a potential source of large quantities of surface water. Smaller streams such as Bucatunna and Souinlovey Creeks could be suitable as surface-water sources provided geologic conditions are suitable for impoundment.

Chemical quality of the surface water in Clarke County is good except in the areas of brine pollution. The surface water is soft to moderately hard, has a color index less than 40 units, and has a pH between 5.5 and 6.5.

Flood hazards are moderate along the flood plains of the Chickasawhay River and the smaller streams in Clarke County. The Okatibbee Reservoir in Lauderdale County will reduce flooding along the Chickasawhay River, but other smaller streams still have the potential to flood and cause severe damage.

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