MISSISSIPPI STATE GEOLOGICAL SURVEY

WILLIAM CLIFFORD MORSE, Ph.D.

Director

BULLETIN 76

YALOBUSHA COUNTY GEOLOGY

By

JAMES TURNER, M. S.

UNIVERSITY, MISSISSIPPI

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LETTER OF TRANSMITTAL

Office of the State Geological Survey
University, Mississippi

August 15, 1952

To His Excellency,
Governor Hugh L. White, and
Members of the Geological Commission

Gentlemen:

Yalobusha County, in the north central part of Mississippi includes parts of two major physiographic provinces, the North Central Hills and the Bluff hills. The larger features of the topography are wide alluvial valleys and low rolling to rugged hills. The county is part of the Yazoo Drainage Basin. Dams now under construction across the Yocona and Yalobusha Rivers will, when completed, back the water up and flood some of the most fertile land of the county.

The oldest formation exposed in the county is the Ackerman, the uppermost formation of the Wilcox series. Unconformably overlying the Ackerman is the Meridian formation, the lowest division of the Claiborne series. The next Claiborne formation, in ascending order, the undifferentiated Tallahatta, rests unconformably on the Meridian, and grades upward into the Winona, of which only a few outliers were left by post-Winona erosion. The Zilpha formation lies conformably on the Winona, but the contact was not observed anywhere in Yalobusha County. The Kosciusko formation, uppermost of the Lower Claiborne, overlaps onto still older formations. That, following the deposition of the Kosciusko, the county area was not a site of deposition until Pliocene time, or that deposits of intervening age were completely removed by erosion, is indicated by the position of the Pliocene Citronelle, superjacent to the Kosciusko and still older formations. Mineral resources of the county are soil, water, and sand and gravel. Lignite and iron ore are present in small quantity.

Very sincerely yours,

William Clifford Morse
Director and State Geologist

CONTENTS

ILLUSTRATIONS

FIGURES

PLATE

YALOBUSHA COUNTY GEOLOGY

JAMES TURNER, M. S.

INTRODUCTION

Yalobusha County is in the north-central part of the State of Mississippi. It is bounded on the north by Panola and Lafayette Counties, on the east by Calhoun County, on the south by Grenada, and on the west by Tallahatchie. It has an area of 490 square miles[1] or 313,600 acres.

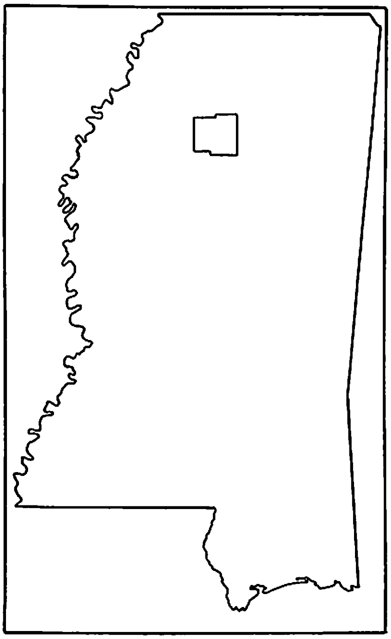

Figure 1.—Location of Yalobusha County.

According to the 1950 census[2] the county had a population of 15,191. The incorporated towns are: Water Valley, Coffeeville, Oakland, and Tillatoba. Water Valley and Coffeeville, the two county seats, have populations of 3,213 and 739 respectively. Communities and villages of the county are: Scoby, Torrance, Bryant, Bruce Junction, Velma, Gums, Spearman, Hyde, Tyson, Brenwood, and a few others which are not on the map.

The chief occupations of the people, outside the few small towns and villages, are farming and lumbering; however, in the western part of the county, digging, washing, and hauling sand and gravel are of some importance. The principal crops are cotton and corn; the chief minor crop is forage. Cattle raising is followed on a small scale. The lumber industry is of some importance also but not what it once was.

Three railroads serve Yalobusha County. A main line of the Illinois Central between Jackson, Mississippi, and Memphis, Tennessee, crosses the southwest corner of the county in a northwest direction practically parallel to U. S. Highway 51 via Scoby, Tillatoba, and Oakland. A branch line of the same system from Grenada to Holly Springs extends northwestward across the central part of the county via Bryant, Bruce Junction, Coffeeville, and Water Valley. The Mississippi Skuna Valley Railroad intersects the branch line of the Illinois System at Coffeeville, extends southwest through Bryant, thence east parallel to Skuna River along the flood plain via Gums, Spearman, Hyde, Tyson, and Brenwood, and on into Calhoun County.

The United States Government is constructing, as part of a flood control project, two dams, one, the Enid Dam, across the Yocona River in the northwestern part of the county, and the other, the Grenada Dam, across the Yalobusha River in north-central Grenada County. Back waters from these dams will flood some of the most fertile land of both counties.

Several years ago the Government purchased approximately 20,000 acres in the southwestern part of Yalobusha County to be used in connection with a land utilization project. Parts of this tract of land have been planted to timber and grasses which are retarding the tremendous erosion that has been going on since the white man denuded the land of its forest covering.

Two paved highways cross the county in a north-south direction. U. S. 51 in the western part, parallel to the Tallahatchie-Yalobusha County line, connects Jackson, Mississippi, with Memphis, Tennessee. Mississippi Highway 7, across the central part of the county, connects Grenada and Holly Springs, via Coffeeville and Water Valley. Preparations for the relocation of the part which will be covered by water when the Grenada Dam is closed are under way.

Here and there are State maintained gravel roads. Inasmuch as gravel of the Citronelle formation is near at hand in the west, most of the county roads in that region are graveled. On the contrary, most county roads in the eastern part are not graveled, and become so slippery when wet that some of the infrequently traveled roads have been abandoned.

CLIMATE

The mean annual temperature at Water Valley, is 62.9 degrees Fahrenheit, the winter, spring, summer, and fall means being 44.7, 62.9, 79.3, and 63.4 degrees respectively. The average yearly rainfall is 53.24 inches. As a rule, the ground freezes a number of times during the winter to a depth of 2 to 3 inches. Snowfall is infrequent and light, and the snow seldom lies on the ground more than a few days. The average date of the last killing frost in the spring is March 27, and of the first in the fall, October 31, so that the average growing season is 218 days. The earliest reported killing frost in the fall was October 11, and the latest in the spring was April 22.[3]

PHYSIOGRAPHY

Yalobusha County lies in two major physiographic provinces. The western quarter is part of the Bluff Hills and the eastern three quarters is part of the North Central Hills.[4] As the name indicates, the North Central Hills part is hilly, the hill tops and ridge tops being as much as 300 feet above the general level of the wide alluvial lowlands of Yocona and Skuna Rivers. The Bluff Hills region is low rolling hills. The relief is not so great as that of the North Central Hills.

DRAINAGE

The whole of Yalobusha County is in the Yazoo River Basin. The territory is drained principally by Yocona and Skuna Rivers and their tributaries.

Yocona River flows southwest across the northwest corner of the county. The point at which it enters the county is at an altitude of 234 feet above mean sea level, and at Enid Dam, which is approximately one mile east of the Yalobusha-Tallahatchie County line, it has an elevation of 192 feet.[5] Thus the stream has a fall of 42 feet in a distance of 14 miles or an average gradient of 3 feet per mile.

Skuna River enters Yalobusha County on the east and flows southwest across the southeast corner of the county. The point of entrance is at an elevation of 220 feet and the point of exit at an elevation of 170 feet.[6] The difference in elevation of the two points, 12 miles apart, is 50 feet; thus the stream has an average gradient of 4.2 feet per mile.

STRATIGRAPHY

The rock formations which crop out in Yalobusha County may be classified as indicated in the following table:

GENERALIZED SECTION OF ROCK UNITS EXPOSED IN YALOBUSHA COUNTY

- Cenozoic group
  - Quaternary
    - Holocene
      - Recent formation
    - Pleistocene
      - Loess formation
  - Tertiary
    - Pliocene
      - Citronelle formation
    - Eocene
      - Claiborne
        - Kosciusko formation
        - Zilpha formation
        - Winona formation
        - Tallahatta formation undifferentiated
        - Meridian formation
      - Wilcox
        - Ackerman formation

ACKERMAN FORMATION

INTRODUCTION

The name "Ackerman formation" was introduced into geologic literature by E. N. Lowe in 1917.[7] The type locality is at Blantons Gap on the Illinois Central Railroad in Choctaw County a mile and a quarter northeast of the railroad station in Ackerman. The Ackerman formation occupies the eastern quarter of Yalobusha County.

LITHOLOGY

The Ackerman is composed of sand, clay, shale, lignite, quartzite, and iron concretions. The basal sand (not present at the surface in Yalobusha County) is white where fresh, cross-bedded, coarse and interlensed with clay, whereas the sands in the upper parts of the formation are fine, yellow to gray, and silty. One of the striking characteristics of the silty sand is the heterogeneous mixture of small flakes of clay which resemble meal bran. Along the very irregular bedding planes of the sand and clay are, in most places, iron cemented crusts. The clays are white, green, gray and black, and are commonly massive where not exposed, but jointed at the surface, due to the loss of connate water. Small spherical to sub-spherical nodules of marcasite are scattered through the clay. Ferruginous concretions are present in several localities throughout the extent of the Ackerman formation in Yalobusha County.

Lignite, a variety of coal between peat and bituminous, where pure is black when wet, but on drying becomes brown; hence, the name "brown coal." A piece of dry lignite placed in water gives out for some seconds a characteristic crackling sound or click. On being exposed to the weather lignite crumbles in a short time. It burns with both flame and smoke and gives off a disagreeable odor. In several localities in the eastern part of the county are beds of lignite up to 2 feet thick.

SECTION 4 MILES EAST OF WATER VALLEY, 100 YARDS NORTH OF BRIDGE ON PARIS ROAD ACROSS A TRIBUTARY OF OTUCKALOFA CREEK (NE.¼, SEC.6, T. 11 S., R. 3 W.)

	Feet	Feet
Meridian formation		20.0
Sand, red coarse; gravelly at the lower contact; becomes finer upward; clay reworked into the basal part; sandstone tubular and cavernous developed here and there	20.0	
Unconformity		
Ackerman formation		68.7
Sand, fine grained, micaceous, yellow, laminated with silty gray clay; sand from above slumped	18.5	
Covered	40.0	
Clay, gray, silty laminated; breaks with conchoidal fractures; contains small masses of siderite	3.0	
Lignite, almost pure; lignitized plant stems extend down into clay below	1.2	
Clay, gray; grades downward into thinly laminated silt containing reworked lignite, marcasite and mica	6.0	
Water level of creek		

Quartzite that contains plant impressions is found in the Ackerman formation at different horizons. One of the best developed beds is at the contact of the Meridian and Ackerman formations 150 yards north of Jones school house in the valley wall of a small intermittent tributary of Skuna River (SE.¼, SE.¼, Sec.26, T.24 N., R.6 E.), where a bed 2 to 3 feet thick is exposed. Here a silt bed is well cemented toward the top, but grades downward through less indurated silt into the gray pulverulent silt. The Meridian sand, which lies above the quartzite contains silicified wood. The sand probably furnished the silica for the cementation of the underlying silts into quartzite and for the replacement of the wood.

Approximately 150 yards northwest of Gray Rock Church S.½, Sec.26, T.25 N., R.6 E.) a 2-foot ledge of quartzite, which contains plant impressions, crops out. In the absence of exposures of beds above and below, it is impossible to determine the stratigraphic position of this rock; however, by projection of the known contact of the Ackerman and Meridian formations, it is determined to be at the contact.

Also quartzite forms within the Ackerman formation (see section below).

SECTION 0.3 MILE WEST OF WATER VALLEY SCHOOL (NW. ¼, SEC. 3, T. 25 N., R. 7 E.)

	Feet	Feet
Ackerman formation		83.5
Covered to top of hill	20.0	
Clay, weathered red that grades downward into gray	15.5	
Lignite	1.0	
Quartzite, containing plant fossils	1.0	
Silt, gray, massive to even bedded; becomes more indurated toward the top	18.5	
Covered to road level at foot of hill at bridge	27.5	

Spathic iron concretions of limonite, hematite, and siderite are present at several localities. Most siderite ($FeCO_3$) is light brown to dark brown. On weathering, siderite changes to hematite, Fe_2O_3, or limonite, $2Fe_2O_3.3H_2O$, or both. Individual masses may have almost any form bounded by plane or curved surfaces.

SECTION 2 MILES NORTH OF THE YALOBUSHA-GRENADA COUNTY LINE AND 3 MILES WEST OF THE YALOBUSHA-CALHOUN COUNTY LINE (S.½, SEC.33, T. 24 N., R. 7 E.)

	Feet	Feet
Meridian formation		25.0
Weathered to top of hill	10.0	
Sand, coarse angular, red, bedded, slightly micaceous	15.0	
Unconformity		
Ackerman formation		140.0
Clay, gray silty	25.0	
Clay, gray, scattered iron concretions in road bank	10.0	
Iron concretions strewn on surface	20.0	
Clay, gray silty and concretions up to 12 inches thick	30.0	
Clay, gray silty and concretions, 0.5 foot thick	5.0	
Clay, gray including bed of iron ore 4 inches to 6 inches thick at top	10.0	
Clay, gray; thin partings of limonite near top of interval	15.0	
Covered to base of hill	25.0	

SECTION ONE MILE NORTH OF GUMS (ALONG LINE BETWEEN SECTIONS 14 AND 23, T. 24 N., R. 6 W.)

	Feet	Feet
Meridian formation		20.0
Sand, red coarse; pebble bearing at contact; becoming progressively finer toward top of exposure	20.0	
Unconformity		
Ackerman formation		15.0
Clay, gray silty; contains spathic iron concretions near the contact. Gravel quartz boulders and spathic iron concretions strewn about its surface to water level	15.0	

PALEONTOLOGY

No paleontological work has been done on the Ackerman formation, but in the absence of marine fossils it is considered to be non-marine. A large assemblage of plant fossils is found in the formation which is indicative of a continental deposit. In fact, semi-aquatic plants were so abundant at times during the Ackerman and preservation so nearly perfect as to form beds of lignite several feet thick. This carbonaceous material colors the sand and clays gray to black.

TOPOGRAPHIC EXPRESSION

The Ackerman formation of Yalobusha County has a dual topographic expression. The clays form low rolling hills and ridges, whereas the sands form hills and ridges more rugged and of greater relief. Many steeply dipping beds are exposed. Most, if not all those observed, can be accounted for by cross bedding and land slips or slumps. Clay and lignite beds commonly dip with the slope of the hill where affected by pressure differential, and against the slope of the hill where affected by land slip. Water adds weight to the material and acts as a lubricant. It is not uncommon after long rainy spells for land slides to occur in the Ackerman clays along hillsides, road cuts, and gullies.

SOILS

The clays of the Ackerman formation give rise to red silty loam; the sands form fine silty micaceous soils. Both are among the poorest agricultural soils of the county. Most of the Ackerman belt is utilized for pasturing and for growing timber.

DEPOSITIONAL CONDITIONS

During Ackerman time the land was low lying and swampy, somewhat similar to the present Mississippi River flood plain. The climate was warm and humid as attested by the abundance of plant material in the formation. At times the water became deeper and clay layers which did not contain lignite except that which had been reworked, were deposited; at other times the currents became swifter, transporting and depositing fine grained sand and silts. In some localities were shallow bodies of water in which plants grew, died, and were preserved, later to be changed into lignite.

MERIDIAN FORMATION

INTRODUCTION

The Meridian formation was named for exposures near the City of Meridian, Lauderdale County, Mississippi, by E. N. Lowe[8] who considered it to be a basal member of the Claiborne series. In 1940 Foster raised it from a member to formation rank and retained it in the basal part of the Claiborne.

LITHOLOGY

The Meridian formation of Yalobusha is predominantly sandy, the sand being rather coarse grained, commonly very micaceous and of various colors where exposed, such as white to yellow, red and purple. Ferruginous sandstone and silicified wood are common in the formation. In most places the basal Meridian is coarse and gravelly and may contain quartz boulders, but in some areas it is laminated and contains clay balls and clay breccia. Higher in the formation the clay inclusions are less numerous. The upper part is fine micaceous variegated, silty sand.

One of the outstanding characteristics of the Meridian sand is the sharply defined fluviatile bedding. Although at most exposures the bedding planes of series are parallel or sub-parallel with each other, they may be horizontal or may dip at high or low angles. A common relationship is that the altitude of the beds of one series is not the same as that of the series above or below: Specifically, a unit having inclined bedding may be, and in most cases is, in juxtaposition with a horizontally bedded unit. However, above or below the horizontal beds another series may be inclined at approximately the same angle as that of the first unit mentioned, or it may be inclined at a different angle, but almost invariably in the same direction.

LOWER CONTACT

The Meridian sand lies unconformably on the eroded surface of the Ackerman formation (Figures 2 and 3). Normally the contact is sharply defined, because of the extreme difference in lithology of the two formations. It is not unusual to find Ackerman clay worked into the base of the Meridian formation. An excellent exposure of the Ackerman-Meridian is at a place (SE.¼, Sec.35, T.24 N., R.6 E.) where the coarse Meridian sandstone is lying on the quartzite of the Ackerman. Over this sandstone is the Meridian sand which extends several miles to the east, capping some of the higher hills and ridges.

THICKNESS

The thickness of the Meridian formation is variable in Yalobusha County. In many places the contact between the Meridian sand and the Tallahatta shale is indeterminable, because of the interlensing of sand and shale, but from logs of wells scattered over the county and from field observations, the thickness is estimated to range from 40 feet to as much as 125 feet.

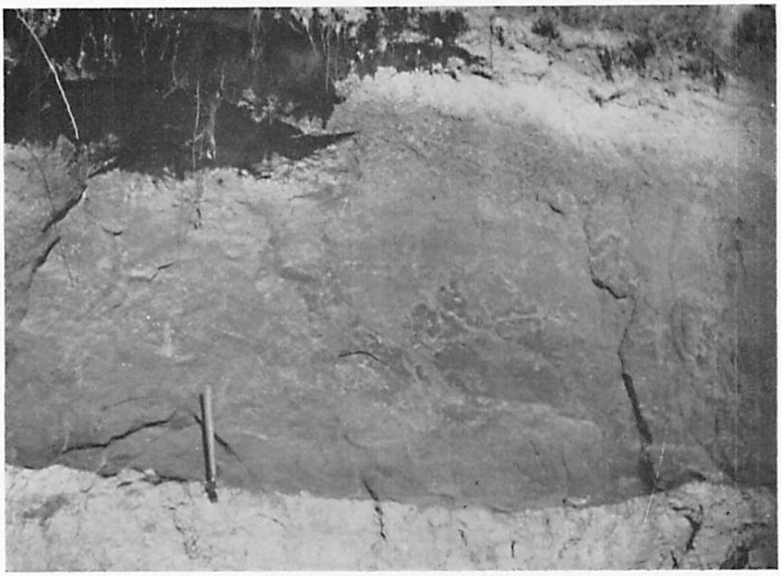

Figure 2.—Ackerman-Meridian contact (SE.¼, NW.¼, Sec.6, T.11 S., R.3 W.) west wall of road cut 100 yards north of intersection of Paris-Water Valley highway. October 12, 1951.

Figure 3.—Ackerman-Meridian contact (E.½, Sec.14, T.11 S., R.4 W.) west wall of creek south of road 3¼ miles east of intersection of Highway 7. March 14, 1952.

DISTRIBUTION

The width of the Meridian belt of outcrop is not constant. The formation is thin in places, probably even missing here and there, whereas elsewhere it is more than 100 feet thick. The maximum thickness, in connection with a dip only 25 feet per mile would give an outcrop belt 4 miles wide, but as a capping of some of the higher hills and ridges it may extend east of the Meridian-Tallahatta contact several miles even into Calhoun County. The strike of the Meridian is almost north-south through Yalobusha County.

TOPOGRAPHIC EXPRESSION

The sand and sandstone of the Meridian formation form rugged hills and ridges of considerable elevation, some of the tops of the hills and ridges being as much as 150 feet above the level of the alluvial lowlands of the streams which have cut their valleys through the Meridian terrane into the underlying Ackerman formation. Many of the higher hills and ridges are held by massive sandstone which forms in the sand. Some of the smaller streams form deep narrow valleys in the Meridian sand, in contrast to the wide alluvial valleys of the larger streams. Some of the greatest erosion scars in Yalobusha County are in the Meridian formation.

SOILS

The soil of the Meridian sand is in general very thin and infertile. Inasmuch as the formation is composed chiefly of coarse sand, rain water percolates rapidly downward through the soil carrying with it most of the soluble mineral matter which is necessary for the growth of vegetation. The Meridian type of land is used chiefly for growing timber and for pasture land.

DEPOSITIONAL CONDITIONS

The Meridian formation was deposited under deltaic conditions as indicated by its fluvial type cross bedding. That the currents were variable, probably due to torrential rains, seems evident from the steep dip of some of the bedding planes in the sand, the horizontal position of others, as already described. Near the close of Meridian time, the streams of reduced velocity carried finer sand and more mica so that in the upper part of the formation the sand is finer and mica more abundant, also the fluvial type bedding disappeared.

TALLAHATTA FORMATION

INTRODUCTION

The name "Tallahatta" was introduced by Dale[9] in 1898 to replace "Buhrstone" which is a structural term. It has been in general use in Mississippi since its introduction by Johnson to replace Hilgard's term "Siliceous Claiborne."

The Tallahatta shale is not so well developed in Yalobusha County as it is farther south in the state. From a well-developed marine deposit in the southeastern part of the state it grades to a poorly developed continental deposit in the north central part.

SECTION OF EXCAVATION FOR BLOW HOLE, ENID DAM (SW.¼, NE.¼, SEC.2, T.11 S., R.7 W.)[10]

	Feet	Feet
Citronelle formation		40.0
Sand and gravel	40.0	
Unconformity		
Kosciusko formation		22.0
Sand, yellow, brown, white, stratified to massive; medium, well-sorted; reworked clay in lower half; completely white in upper half	22.0	
Unconformity		
Zilpha formation		5.5
Sand, coarse, and gray clay, mottled red and yellow	5.5	
Winona formation (?)		4.0
Sand, glauconitic green coarse	4.0	
Tallahatta formation		41.5
Sand, micaceous, very fine bright yellow	3.0	
Sand and clay shale, irregularly interbedded carbonaceous, micaceous, marcasitic, glauconitic	16.5	
Clay shale, black carbonaceous, marcasitic, glauconitic, micaceous, sandy	22.0	

In 1942 Thomas[11] introduced a new member of the Tallahatta, the "Neshoba" which is best developed in Neshoba County, the type locality being near the village of Neshoba. Due to the lensing of sand and shale, and a change of lithology it is impracticable to differentiate the Basic City shale from the Neshoba in Yalobusha County. In this report the terrane is termed undifferentiated Tallahatta.

LITHOLOGY

The Tallahatta formation has a varying lithology. In the southeastern part of Mississippi "it is composed chiefly of siltstone and sandstone."[12] In Yalobusha County the undifferentiated

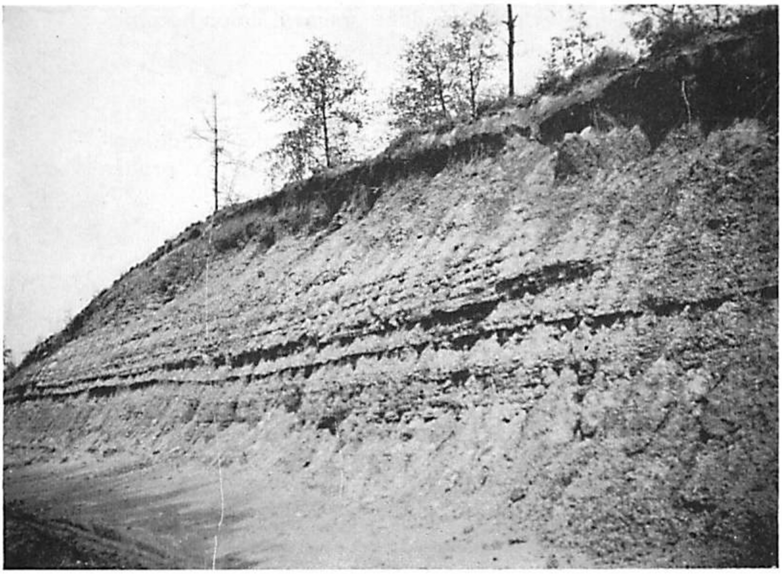

Figure 4.—Interbedded Tallahatta sand and shale (SE.¼, NE.¼, Sec.24, T.11 S., R.6 W.) 1 mile west of Billy's Creek along new Highway 32. April 17, 1952.

Tallahatta formation is composed of glauconite, sand, shale and shale interlensed with sand (Figure 4). In some areas glauconite is heterogeneously mixed with the sand, shale and fucoids in the upper portion of the formation.

The lithology of the Tallahatta formation has distinctive characteristics which make it an excellent horizon marker. Along the bedding of the shale are invariably small flakes of white mica and small grains of quartz sand. On drying, the shale of Yalobusha County which is very light in weight, splits into flakes that are very thin (paper shale).

SECTION OF ROAD CUT ON NEW HIGHWAY 32 ONE MILE EAST OF LONG BRANCH (NE. ¼, SE. ¼, SEC. 22, T. 11 S., R. 6 W.)

	Feet	Feet
Kosciusko formation		14.0
Weathered	3.0	
Sand, red, coarse, poorly laminated	10.0	
Sandstone, ferruginous	1.0	
Unconformity		
Winona formation		17.0
Sand, green very glauconitic in lower part; contains thin laminae of clay in lower part. Glauconite and clay become less abundant upward, color becomes red toward upper contact	17.0	
Conformable contact		
Tallahatta formation		2.0
Clay, sand, fucoids and glauconite which grade upward into the Winona and the Winona grades downward likewise	2.0	
Road level of north bank		

LOWER CONTACT

The contact between the Tallahatta and the underlying Meridian formation is not well defined because the Meridian sand is interlensed with the Tallahatta sand and shale (Figure 5). The sand lenses in the shale are apparently the same as the Meridian sand below. The lower contact in Yalobusha County is set where the interlensed sand and shale give way to the homogeneous sand below .

SECTION OF WEST VALLEY WALL OF SMALL CREEK 1 MILE SOUTHWEST OF BRYANT ALONG COUNTRY ROAD (NE. ¼, SE. ¼, SEC. 25, T. 24 N., R. 5 E.)

	Feet	Feet
Weathered zone	3.0	3.0
Tallahatta formation		25.4
Shale, gray, silty, mica and sand along laminae	16.9	
Sandstone	0.3	
Shale, gray, silty, mica and sand along laminae	1.8	
Sandstone	0.4	
Shale, gray, silty, mica and sand along laminae	0.6	
Sandstone	0.1	
Shale, silty, white flaky micaceous	5.3	
Meridian formation		7.5
Sandstone, red, laminated poorly consolidated	1.5	
Sand, red, coarse, sorted small clay flake and clay ball inclusions cross-bedded	6.0	
Water level		

The lower part of the Tallahatta is interlensed sand and clay strata that become more shaly toward the upper part of the formation. In the vicinity of Grenada the lower beds are almost black and contain lignitic fragments and leaf impressions. These beds were named "Grenada" by E. N. Lowe[13] and were correlated with the Hatchetigbee formation in Lauderdale County, Missis-

Figure 5.—Meridian Tallahatta contact (SW.¼, SW.¼, Sec.32, T.10 S., R.4 W.) 25 yards south of bridge on new road, ½ mile west of Water Valley. October 12, 1952.

sippi. Later workers have found this correlation to be in error and have included the "Grenada" in the Tallahatta formation. Upward from the basal shales the supposed formation becomes a fine silty, micaceous, variegated sand which includes clay stringers. This part is probably equivalent to the Neshoba sand in Neshoba County, Mississippi, as described by Thomas or to the lower part of the Winona as described by Priddy.

DISTRIBUTION

The width of outcrop of the Tallahatta formation in Yalobusha County is variable. In some of the higher hills in the northern part, the formation may extend almost to the Calhoun County line, and in some of the deeper valleys it may be exposed as far west as the Tallahatchie County line. During the construction of Enid Dam which is approximately one mile east of the Tallahatchie County line, the shale was exposed 41.5 feet above the water level of Yocona River. In the southeastern part of Yalobusha County the width of outcrop is not so great, because there is not so much difference in elevation in the southern part as in the northern.

THICKNESS

The thickness of the undifferentiated Tallahatta is variable due to erosion. It is estimated to be as much as 300 feet in some places, whereas at others it is very thin or may be completely missing. Thomas[14] states that the maximum thickness of the undifferentiated Tallahatta in Grenada County is 200 feet.

FOSSILS

The carbonaceous beds of the Tallahatta formation in Yalobusha County contain plant fragments and leaf impressions. No marine fossils have been found in this county, but in adjoining Lafayette County, marine fossils have been found which indicate that marine conditions existed in this region part of the Tallahatta time.[15]

SECTION IN DITCH 75 FEET SOUTH OF BRIDGE 1.5 MILES WEST OF WATER VALLEY (SW.¼, SEC.32, T.10 S., R.4 W.)

	Feet	Feet
Tallahatta formation		30.0
Shale, gray laminated containing partings of micaceous white silty sand; marcasitic nodules a few thin beds of jet-black shale; perfect imprint of leaves and plant fragments	30.0	
Unconformity		
Meridian formation		6.0
Sandstone, laminated, chalcedony (?) along laminations; becomes less indurated downward	3.0	
Sand, coarse, yellow, iron oxide red, poorly laminated	3.0	
Creek level		

TOPOGRAPHIC EXPRESSION

Due to the sandy character of the Tallahatta formation in Yalobusha County, the relief of the hills and ridges is not so great as that of the surface farther south where the shale is less sandy. The hills and ridges slope gently to the valleys.

SOILS

The Tallahatta weathers to a fine micaceous silty sand which is very poor for agricultural purposes. The top soil is thin and very poor in mineral plant food. The hilly portion of the formation is used to grow timber; however, some of the bottom lands are profitably farmed.

DEPOSITIONAL CONDITIONS

The Tallahatta was deposited under varying conditions. The shale was deposited in rather quiet water, but the sand was deposited in water whose currents were more active. Some of the shale was deposited in shallow water near shore for it contains plant fragments and leaf impressions. At other times the deposition was in deeper water and farther from shore, as indicated by marine fossils where no plant fragments are present. At the same time the purer shale was being deposited to the southeast, sand was being introduced in the northern part of the state, where the shale is more sandy and contains numerous sand lenses.

WINONA FORMATION

INTRODUCTION

The name "Winona" was introduced by E. N. Lowe[16] in 1919 for greensands which are well developed around Winona, Montgomery County, Mississippi. His original definition is:

"The Winona sand as found in the western part of its outcrop. especially well developed around Winona, Vaiden, and eastward into adjacent counties, consists of 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. . . ."

Most authors had considered the Winona to be a member of the Tallahatta or of the Lisbon formation until Thomas raised it to formational rank in 1942.

Priddy[17] described three parts of the Winona formation in Montgomery County (1) a basal non-glauconitic non-fossiliferous iron stained quartz sand containing discontinuous clay lenses, 20 feet in thickness (2) a middle slightly glauconitic sparingly fossiliferous ferruginous quartz sand 30 to 40 feet in thickness (3) an upper very glauconitic very ferruginous quartz sand containing casts of pelecypods, about 20 feet in thickness.

Thomas[18] places the non-glauconitic to sparingly glauconitic non-fossiliferous marine sands, which are correlative with Priddy's two lower divisions of the Winona, in the Neshoba member. Thomas also says that in northern Montgomery County

Figure 6.—Winona-Citronelle contact (NE.¼, NW.¼, Sec.8, T.24 N., R.4 E.) on U. S. Highway 51, 1 mile south of Tillatoba and 1 mile east of the Tallahatchie County line. April 17, 1952

and in Grenada County the Neshoba thins and shows a decided change of facies and the sands and shales are in the undifferentiated Tallahatta.

Priddy[19] describes an outcrop in southwest Yalobusha County of the higher beds of the lower Winona as:

"A sharp road cut (NE. ¼, NW. ¼, Sec. 8, T. 24 N., R. 4 E.) on U. S. Highway 51, one mile south of Tillatoba and a mile east of the Tallahatchie line shows 7.9 feet of glauconitic sand overlain by pipe-like ferruginous sand concretions and gravelly Citronelle sandstone" (Figure 6).

SECTION (NE ¼, NW. ¼, SEC. 8, T. 24 N., R. 4 E,) EXPOSED BY HIGHWAY 51 CUT 1 MILE SOUTH OF TILLATOBA

	Feet	Feet
Citronelle formation		
Pipe like ferruginous sand concretions and gravelly Citronelle sandstone		
Winona formation		28.8
Glauconitic sand (outcrop)	7.9	
Sand, fine grained brown micaceous (test hole)	6.5	
Sand, medium grained rusty red fairly micaceous; thin partings of ferruginous sandstone (test hole)	2.8	
Sand, fine grained to medium grained buff dark flecked fairly micaceous (test hole)	1.0	
Sand, fine grained to medium grained flesh pink very micaceous; light greenish gray flecks (test hole)	0.3	
Sand, fine grained light greenish buff slightly micaceous (test hole)	6.4	
Sand, fine grained to medium grained dark greenish buff fairly micaceous (test hole)	3.9	

There has been found in Yalobusha County only one other outcrop which has been determined to be Winona:

SECTION OF ROAD CUT ON NEW HIGHWAY 32 ONE MILE EAST OF LONG BRANCH (NE. ¼, SE. ¼, SEC. 22, T. 11 S., R. 6 W.)

	Feet	Feet
Kosciusko formation		14.0
Weathered	3.0	
Sand, coarse, poorly laminated	10.0	
Sandstone, ferruginous	1.0	
Unconformity		
Winona formation		17.0
Sand, green, very glauconitic in lower part; contains thin laminae of clay in lower part; glauconite becomes less abundant upward; color becomes red toward upper contact	17.0	
Conformable contact		
Tallahatta formation		2.0
Clay, sand, fucoids; grades upward into the Winona, to road level of north bank	2.0	

DISCUSSION

The Winona formation in Yalobusha County is composed of sand, glauconite, and thin partings and flakes of clay. At no place in the county has there been found Winona weathered to such stage as to form siderite and hematite which are so common in the weathered part of the glauconitic sands. The upper part of the formation is red, due to the weathering of iron in the glauconite.

At only one place (NE.¼, SE.¼, Sec.22, T.11 S., R.4 E.) in Yalobusha County has the contact between the Tallahatta and Winona been found. The contact is conformable and gradational:

Figure 7.—Tallahatta-Winona contact (at hammer) (NE.¼, SE.¼, Sec.22, T.11 S. R.6 W.) 1 mile east of Long Branch along new Highway 32. April 17, 1952.

The sand. clay, and glauconite grade downward into the sand, silt, shale and fucoids of the Tallahatta, and the Tallahatta grades upward likewise into the Winona (Figure 7).

The thickness of the Winona is 15 feet in Yalobusha County where its upper and lower contacts are exposed in a sharp road cut (NE.¼, SE.¼, Sec.22, T.11 S., R.6 W.), on new Highway 32 one mile east of Long Branch.

No fossils have been found in the Winona outcrops in Yalobusha County, although southward along the strike, near the type locality at Winona some Winona beds are fossiliferous.

Due to the overlying formations, the two small outcrops of the Winona do not have any topographic expression.

The Winona material on weathering, becomes an intense red and is associated with the formation of hematite and limonite at the expense of glauconite. The soil is fertile and is excellent for farming. At places the Winona soils are difficult to cultivate because of the concentration of limonite.

That the Winona glauconitic greensand was deposited in a marine environment is certain, inasmuch as glauconite is always formed under marine conditions. The composition of glauconite is uncertain and variable, $KFeSi_2O_6$ alone being distinguished by a large percentage of potash.[20] No paleontological work has been done on the Winona in this investigation, but in Montgomery County, at the type locality, opalized marine fossils are found, further conclusive evidence that the Winona is a marine deposit.

ZILPHA FORMATION

INTRODUCTION

The term "Zilpha" was introduced into geologic literature in a guidebook for the Claiborne and Wilcox field trip of the Mississippi Geological Society (March, 1940).

The original definition is: "A workable bed of gray-white and chocolate-brown clay, having a thickness of about 60 feet. was found to lie between the Winona and Kosciusko in north central Mississippi in Carroll, Grenada, and Attala Counties. Mr. Raymond Moore, formerly with the Arkansas Fuel Oil Company, found this to be a good key horizon and suggested the name of Zilpha from Zilpha River in Attala County."

In 1942 Thomas[21] gave the Zilpha shale formational rank because:

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 the introduction of a new formational name since both of these names are restricted to other divisions and should not be expanded to include the Zilpha section.

LITHOLOGY

The Zilpha formation, in Yalobusha County, is composed of gray to light chocolate-brown silty sand and shale, which weather to a dark brick-red clay. The lower contact of the formation has not been found exposed in Yalobusha County because of the overlap of the Kosciusko formation. Thomas[22] states, "The lower part of the section is typically a nearly-pure blocky clay whereas the upper portion is much more silty and shaly."

SECTION 100 YARDS NORTH OF ST. ANDREWS CHURCH ALONG THE SETTLEMENT ROAD (SW. ¼, SE. ¼, SEC. 19, T. 11 S., R. 6 W.)

	Feet	Feet
Citronelle formation		20.0
Sand and gravel poorly sorted heterogeneously mixed	10.0	
Covered, probably Citronelle	10.0	
Zilpha formation		38.5
Clay, silty, micaceous, greenish gray; contains fossil plant fragments; weathers red	10.0	
Iron concretions, highly weathered along the same plane in the clay	1.0	
Clay, less silty than above contains fossil plant fragments	27.5	
Covered to base of hill		

LOWER CONTACT

No place in Yalobusha County has been found where erosion has cut through the Kosciusko and Zilpha and exposed the contact of the Zilpha and underlying formation. Thomas[23] states that: "The lower Zilpha-Winona contact is conformable and sharply defined. The material at the contact proper is a heterogeneous mixture of carbonaceous clay, glauconite and quartz sand. Below this horizon the clay diminishes and disappears whereas above it the glauconite and quartz sand gradually do likewise. The actual transition from one facies to the other takes place within one half to three feet of section except in a few places in Attala County where the two facies are found interbedded at the contact. The lithology of the overlying and underlying beds and the sharpness of the contact represent a rapid change from shallow marine to marsh conditions. The heterogeneity of the material at the contact was probably caused by wave agitation during the change of conditions."

THICKNESS

The thickness of the Zilpha varies over short distances. Along a public road one and one half miles west of Long Branch (NW.¼, Sec.21, T.11 S., R.6 W.) is a contact of the Kosciusko and Tallahatta formations. Two and one half miles east of it is an exposure of Zilpha clay. The clay seems to have been deposited in an erosion channel in the Tallahatta formation. Its exposed thickness at this point is 60 feet. From well logs[24] the thickness of the Zilpha, in Tallahatchie County immediately west of Yalobusha, varies from absent to as much as 65 feet at the Phillip stave mill (NW.¼, SW.¼, Sec.21, T.22 N., R.1 E.). The varying thickness is evidence that the Zilpha was deposited on an eroded surface and the Tallahatta or the Zilpha was deeply to completely eroded, before the deposition of the Kosciusko.

FOSSILS

No paleontological work has been done on the Zilpha formation in Yalobusha County, but the formation contains a large assemblage of plant fossils and plant fragments from which the formation gets its gray to brown color.

DISTRIBUTION

In Yalobusha County the width of outcrop of the Zilpha clay is variable. In the northern part its outcrop is not more than half a mile wide, exposed only where erosion has cut through the Kosciusko formation. In the central part of the county the Zilpha is not exposed due to the overlapping Kosciusko, Citronelle and Loess formations. In the southwestern part of the county on the upthrow side of the fault described by Priddy,[25] the Zilpha has an outcrop width of two to three miles.

TOPOGRAPHIC EXPRESSION

In most places where the Zilpha clay is exposed in gullies and along road cuts, it is overlain by younger formations and does not have a topographic expression. In a few small areas where it is not covered it forms a topographic flat.

SOILS

Zilpha clay, on weathering, gives rise to a reddish-tan and light-gray silty soil which gullies easily. When not protected by some form of vegetation or properly terraced, it soon becomes a maze of gullies. This type of soil is rarely used for row crops, but is maintained as pasture and timber lands.

DEPOSITIONAL CONDITIONS

The lower contact of the Zilpha has not been found in Yalobusha County and the nature of its lower part there is not known. Thomas[26] states, "The Zilpha shale was deposited during a time of change from marine to non-marine conditions. The formation has characteristics of both types of deposits." The Zilpha formation in Yalobusha County is composed of carbonaceous clay, silt, and shale, which is indicative of probable lake, bay and coastal deposits. The iron concretions which are in the silt indicate that the water from which the formation was formed contained iron. The carbonic acid from decaying vegetable matter caused the precipitation of siderite ($FeCO_3$) which on weathering changes to hematite (Fe_2O_3) and limonite ($2Fe_2O_3.3H_2O$). Carbonaceous material in the Zilpha has not been found concentrated enough to be termed lignite.

KOSCIUSKO FORMATION

INTRODUCTION

The term "Kosciusko" was proposed by Cooke in 1925[27] to replace Lowe's term "Decatur," which was preoccupied. Cooke's original definition is: "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, Mississippi, and for the unconsolidated sands of the same age in Mississippi." In 1942 Thomas[28] raised the Kosciusko sandstone member to formational rank because: "It is a lithologic unit having definite upper and lower boundaries and a wide areal distribution."

LITHOLOGY

The Kosciusko formation in Yalobusha County is a heterogeneous mixture of sand, ferruginous sandstone and fragmental quartzite. The sand is made up, almost wholly, of quartz grains, which are white to light colored when fresh and weather to tints of red, yellow, brown, purple and gray. The bedding of the formation is diagonal to even to massive.

Sandstone, most of it tubular, is common in the Kosciusko. In all places the tubes point southwest-northeast. Some of the sandstone is massive or shows the same bedding structure as the surrounding sand. This is a criterion for determining that the sandstone is secondary in origin.

Quartzite, which immediately overlies the Zilpha clay, is common in Attala and surrounding counties. In Yalobusha County although no quartzite was found in place, it is scattered about on the surface of the Kosciusko and even on the surface of

Figure 8.—Quartzitic boulders of the Kosciusko formation (NW.¼, NW.¼, Sec.29, T.10 S., R.4 W.) Camp Ground School. April 17, 1952.

lower beds, which leads the writer to believe that the quartzite was formed in the Kosciusko formation and was removed by subsequent erosion (Figure 8).

In the lower part of the Kosciusko are invariably clay balls, clay breccia and clay partings which become less numerous upward.

LOWER CONTACT

In Yalobusha County the Kosciusko sand overlaps at least three of the older formations. Its contact with the different

Figure 9.—Tallahatta-Kosciusko contact (SW.¼, SW.¼, Sec.32, T.11 S., R.4 W.) north bank of new road ½ mile west of Water Valley. April 17, 1952.

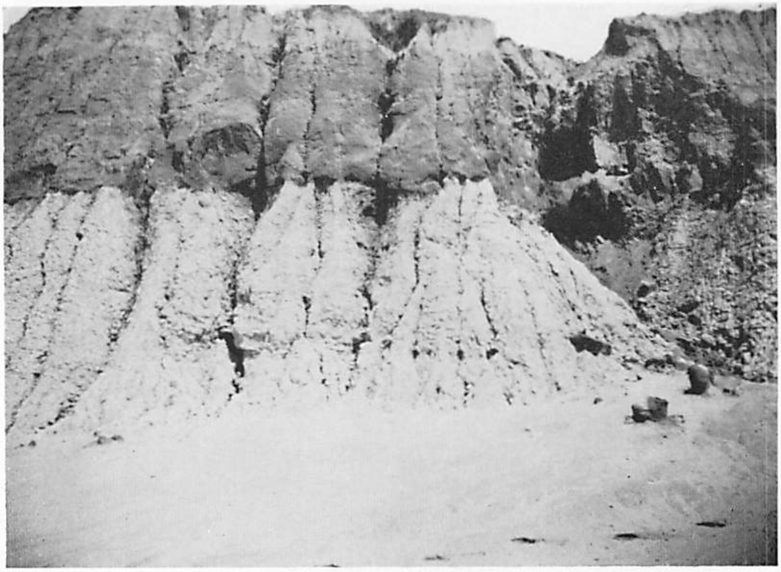

Figure 10.—Basal conglomerates of the Kosciusko formation (NW.¼, SW.¼, Sec.22, T.11 S., R.6 W.) ¼ mile east of Long Branch along new Highway 32. April 17, 1952.

formations shows different characteristics (Figure 9). The Zilpha-Kosciusko contact is unconformable. Clay in the form of balls, breccia, stringers and flakes is found at the contact and becomes less abundant upward. An excellent exposure (NW.¼, SW.¼, Sec.22, T.11 S. R.6 W.) of this feature is one-fourth mile east of Long Branch on new Highway 32, where the clay breccia in the lower part of the Kosciusko grades upward into a coarse massive sand (Figure 10). An exposure of the Winona-Kosciusko contact is shown by the road cut (NE. ¼, SE. ¼, Sec. 22, T. 11 S., R. 6 W.) on new Highway 32 one mile east of Long Branch. The contact is unconformable and distinct, and is well defined by a one-foot bed of ferruginous sandstone. There is a well exposed Tallahatta-Kosciusko contact in a road-side ditch on old Highway 32 (NE. ¼, SE. ¼, Sec. 23, T. 11 S., R. 6 W.), a quarter of a mile southwest of its junction with new Highway 32. At this place the chocolate-colored Tallahatta shale is overlain by the Kosciusko sand and sandstone. Above the contact, which is set at the base of the bed of sandstone, flakes of silty clay shale are worked into the sand but become less numerous upward in the formation. Thin beds of tubular sandstone have developed in the sand to as much as 20 feet above the contact.

SECTION (NE.¼, SEC.23, T.11 S., R.6 W.) TWO MILES EAST OF LONG BRANCH ON NEW HIGHWAY 32 BEGINNING AT MOUTH OF GULLY 50 YARDS SOUTH OF HIGHWAY AND ENDING AT TOP OF HILL ON COUNTY ROAD 100 YARDS NORTH OF HIGHWAY (FIGURE 11).

	Feet	Feet
Kosciusko formation		38.5
Sand, coarse to medium grained variegated; platy and tubular sandstone, tubes pointing northeast-southwest; beds dip southwest; sand becomes more massive toward top	27.5	
Clay balls interlensed with sand	11.0	
Covered interval		31.0
Covered from highway to road to north; a Zilpha-Kosciusko contact probably is in this interval	31.0	
Zilpha formation		29.0
Clay, and weathered clay in north highway bank	4.0	
Covered to road level	11.0	
Clay, light gray, silty, contains plant fragments and leaf impressions, to mouth of gully	14.0	

A Winona-Kosciusko contact is exposed by a road cut on new Highway 32 in which the Winona green sand and the Kosciusko

Figure 11.—Zilpha-Kosciusko contact (NE.¼, Sec.23, T.11 S., R.6 W.) 2 miles east of Long Branch along new Highway 32. October 12, 1951.

Figure 12.—Winona-Kosciusko contact, at ledge of ferruginous sandstone (NW.¼, SE.¼, Sec.22, T.11 S., R.6 W.) 1 mile east of Long Branch along new Highway 32. April 17, 1952.

sand are sharply defined and separated by a one-foot bed of ferruginous sandstone.

SECTION (NW. 1/4, SE. 1/4, SEC. 22, T. 11 S., R. 6 W.) ON NEW HIGHWAY 32 ONE MILE EAST OF LONG BRANCH (FIGURE 12).

	Feet	Feet
Kosciusko formation		14.0
Weathered soil and subsoil	3.0	
Sand, coarse, red, poorly laminated	10.0	
Sandstone, ferruginous coarse	1.0	
Winona formation		17.0
Sand, green, grades upward to red; highly glauconitic; contains clay partings near base, which become less pronounced toward top	17.0	
Conformable contact		
Tallahatta formation		2.0
Sand, shale, glauconite and fucoids, to road level	2.0	

Because of the similarity of the upper part of the Meridian sand to the Kosciusko sand, it is indeterminable whether or not the Kosciusko overlapped onto the Meridian.

THICKNESS

The thickness of the Kosciusko formation is variable in Yalobusha County. At some places the formation is missing, at others it is as much as 200 feet thick. In a section at Enid Dam (SW.1/4, NE.1/4, Sec.2, T.11 S., R.7 W.) 22 feet of Kosciusko sand was measured.

In a section on Highway 32 one-fourth mile west of Bean Creek (NW.1/4, SW.1/4, Sec.27, T.24 N., R.4 E.) the sand and gravel of the Citronelle are resting on the silty clay of the Zilpha, the Kosciusko being absent.

Thomas[20] gives the thickness of the Kosciusko formation at 85 feet along the Mississippi-Alabama state line to more than 400 feet in Attala, Holmes, and Carroll Counties. Inasmuch as the Kosciusko was deposited on the deeply eroded surfaces of the underlying formations, its thickness is variable over short distances.

DISTRIBUTION

In Yalobusha County the width of the Kosciusko outcrop is variable, averaging about 8 miles. Numerous outliers form rounded hills and are held up by massive to tubular sandstone.

Some of these hills may extend as much as 20 miles up dip east of the westernmost Kosciusko outcrop.

To the north in Lafayette County the outlying Kosciusko sandstone-capped hills stand at a higher elevation than the surrounding hills. A notable example is Thacker Mountain. Similar examples to the south in Montgomery County are the hills east of U. S. Highway 51 and north of Duck Hill. In Yalobusha County southward along the strike, the formation becomes thicker and the outcrop wider.

TOPOGRAPHIC EXPRESSION

The Kosciusko sand in Yalobusha County forms cuestas with steep escarpments, especially where the hills and ridges are held up by sandstone. In localities where sandstone has not formed the topography is rolling and of less relief. East of the main area of outcrop are hills which form an almost straight line along the strike. These hills capped by massive tubular sandstone, form one of the most striking topographic features of the county, especially conspicuous when viewed from the air. Some of the greatest scars left by erosion are in the Kosciusko formation.

SOILS

The Kosciusko formation, in Yalobusha County, weathers to a fine silty loam which is very unfertile. In many places it has been abandoned for farm use, thus made readily available to the erosive action of the wind and rain, which have cut long, wide, deep gullies in the hill sides. Approximately 20,000 acres of this type of soil in the southwestern part of the county were bought by the Government for use in a Farm Security Administration land utilization project. Parts of this land have been planted to forest and pasture, which have greatly retarded erosion.

DEPOSITIONAL CONDITIONS

The absence of marine fossils, glauconite, and lime in the Kosciusko formation of Yalobusha County is an indication that the formation was deposited in a non-marine environment. Cross bedding, clay-ball conglomerates, and local erosional channels in the sand indicate a stream laid origin.

Before the Kosciusko was deposited the underlying beds were deeply eroded. In some areas, many of them were entirely removed, and others were deeply channelled. It is because of this pre-Kosciusko erosion the formation has such varying thickness and overlap.

After the close of Zilpha deposition the source area for the Kosciusko was elevated, or erosion may have tapped material that furnished sediments which were transported by rivers to the Kosciusko deposition site.

CITRONELLE FORMATION

INTRODUCTION

The term "Citronelle" was introduced by G. C. Matson[30] in 1916 for exposures around Citronelle, Mobile County, Alabama. The Citronelle formation is composed chiefly of sand and gravel, although in some areas it contains clay. By the floral content of clay from a few miles south of the type locality near a station called Lambert E. W. Berry[31] determined the age of the formation to be Pliocene.

In Yalobusha County a long interval of time elapsed between the close of Kosciusko deposition and the beginning of Citronelle deposition—in fact, long enough for the accumulation of the remainder of the Eocene, and the entire Oligocene and Miocene. During that time erosion cut through the Kosciusko and into the Zilpha, as attested by the fact that at numerous places the Citronelle is resting on the Zilpha and in other places on the Kosciusko.

LITHOLOGY

The Citronelle formation in Yalobusha County is composed chiefly of red sand, gravel, and ferruginous conglomeratic sandstone. The sand and gravel are heterogeneously mixed, cross bedded to massive. The gravel is chert and crystalline quartz pebbles, chert being by far the most numerous. It ranges in size from cobbles or boulders several inches in diameter down to pebbles not much larger than grit. Scattered here and there through the formation are beds of conglomeratic sandstone which have been cemented by iron oxide.

LOWER CONTACT

The Citronelle formation lies unconformably on the Kosciusko where the Kosciusko is present (Figure 13), and on the Zilpha where the Kosciusko has been removed by erosion. At one place in the county, the Citronelle lies on the upper beds of the lower Winona. Priddy[32] describes the exposure of the contact between the Winona and Citronelle formations: "Still higher beds of the Lower Winona sand crop out in west Yalobusha County. A sharp road cut (NE. ¼, NW. ¼, Sec. 8, T. 24 N., R. 4 E.) on U. S. Highway 51 one mile south of Tillatoba and one mile east of the

Figure 13.—Kosciusko-Citronelle contact (at hammer) (SE. ¼, NW. ¼, Sec. 27, T. 11 S., R. 6 W.) 100 feet east of Bean Creek along Highway 32. April 17, 1952.

Tallahatchie County line, shows 7.9 feet of glauconitic sand overlain by pipe-like ferruginous sand concretions and gravelly Citronelle sandstone."

THICKNESS

Data obtained from well logs and test holes in Tallahatchie County, and from exposures in Yalobusha County indicate that the thickness of the formation ranges from about zero in some places to more than 150 feet in others. The difference in thickness is due to the deposition of the Citronelle, as before stated, on the eroded surfaces of the underlying formations and to post-Citronelle erosion before the deposition of the loess.

FOSSILS

No marine fossils have been found in the Citronelle formation if we except a few of Paleozoic age, contained in the individual pieces of gravel. The gravel has been moved from its original place of deposition; therefore, the incorporated fossils are not a criterion for determining the age of the deposition of the Citronelle. Plant fossils are found in clay at and around the type locality. As already mentioned, it was by these fossils that Berry determined the age of the formation to be Pliocene.

DISTRIBUTION

The Citronelle outcrop area in Yalobusha County is practically parallel to the Yalobusha-Tallahatchie County line and has an average width of 5 miles. In places it is covered by a thin blanket of loess which becomes thicker westward. In the lowlands of the rivers and creeks the outcrop belt shifts westward, whereas in the central part of the county, where the elevation is greater, it extends farther eastward. There are not so many outliers of the Citronelle as there are of some of the older formations.

TOPOGRAPHY

The sand and gravel of the Citronelle formation have a dual topographic expression. Where the thin blanket of loess covers the formation are low rolling hills; in areas where loess has been removed are steeper hills with deeper valleys. Two factors which determine the more nearly level topography in the western part of the county are that the surface there is at a lesser elevation than the surface in the eastern part and that in the western part the formation (Citronelle) is younger and has not been subjected to as much erosion as have the older beds.

SOIL

The soil of the Citronelle formation is thin, in Yalobusha County, and is very undesirable for farming. Water, which falls on the surface, readily percolates downward, thus dissolving soluble mineral matter which is necessary to the growth of vegetation and carrying it away in the ground water.

DEPOSITIONAL CONDITIONS

The Citronelle formation was deposited along the western border of Yalobusha County, on the eroded surfaces of the

Winona, Zilpha, and Kosciusko formations, by a southward flowing river or rivers, which brought the material from higher lands north. The current of the river was strong enough to transport gravel several inches in diameter. At times the currents were less active, as indicated by the deposition of sand and silts. The age of some of the source material was Paleozoic.

LOESS FORMATION

INTRODUCTION

A blanket of loess so thin and weathered that its true relation to the underlying formation cannot be determined covered the western part of Yalobusha County. However, in a few areas its influence is noticeable. In the Oakland area, for example, where the loess is somewhat thicker than in some other places the faces of the walls of the road cuts stand more nearly vertical and the vegetation is more abundant.

DEPOSITIONAL CONDITIONS

"Two theories of origin of loess are to the fore. The first and that held by the Mississippi Geological Survey and by the U. S. Geological Survey, is that the loess is a rock flour formed by glacial action, transported and deposited by glacial waters, and reworked and re-deposited by winds. The second theory which has of late been advanced largely and supported by the Louisiana Geological Survey, maintains that loess is alluvial silt, formed through the uplift and subsequent eluviation of floodplain sediments."[33]

STRUCTURAL GEOLOGY

Yalobusha County beds are composed predominantly of unconsolidated sand and clay. Most of the older beds were eroded before the deposition of the younger ones which were in turn eroded before the deposition of the next. Erosion seems to have been greater in the western part of the county, where some of the beds were completely removed and numerous outliers remain. Due to deposition on highly eroded surfaces some of the beds seem out of place. At several places in the county beds have abnormal dips, but intensive study has shown that in most areas, the dips could be attributed to crossbedding, landslides, or deposition on uneven surfaces. However, in some areas the outcrops of dipping beds are small and the surrounding territory is covered, making it almost impossible to determine the cause of the dip.

Priddy[34] shows, on his "Regional Structure Map Tallahatchie and Adjacent Counties," two faults in western Yalobusha County. The southern fault crosses the southeast corner of Township 24 North, Range 4 East in a northeast-southwest direction. The upthrow side is on the south. The other fault, shown on the map crosses the extreme northwest corner of the county in a northeast-southwest direction. The upthrow side of this fault also is on the south. The northern of the two faults passes through the area where the Enid Dam is under construction, and was encountered during the work on the dam.[35]

Because of interformational erosion and the mantle of loess, sand, and gravel, and also because of the lack of topographic maps and sufficient and reliable well data it was impossible to trace these faults or to determine whether or not others are present.

ECONOMIC GEOLOGY

In most areas of Yalobusha County, a plentiful supply of water for domestic use, is obtained from wells less than 100 feet deep. In villages and towns where a more abundant supply is needed, wells have to be sunk to a greater depth. Overflowing wells have been obtained in the Skuna River bottom and along some of its tributaries. Numerous flowing wells have also been obtained along Otuckalofa Creek, in and around Water Valley and along some of the tributaries of Yocona River. Generally the water is suitable for domestic use. In the Ford's Well area (Secs. 13 and 14, T. 11 S., R. 6 W.) the water is highly mineralized. In years gone by Ford's Well was a flourishing health resort because the water was believed to have medicinal properties.

Lignite is found in the Ackerman formation. Commonly it contains an abundance of impurities and sand, silt, and clay; although some beds are thick enough and pure enough to be used locally as fuel. However, in general, lignite is not suitable for use as fuel, because of its tendency to crumble easily which makes it difficult to handle, especially to ship. Furthermore, the heat value of lignite is much less than that of coal. The heat value of lignite from Yalobusha County is 9,706 B. T. U. whereas the fuel value of bituminous coal from Kentucky is 14,319 B. T. U.[36] For all these reasons lignite can not compete with coal as a fuel.

At some horizons in the Ackerman silty clay, thin beds of carbonate iron have formed. These beds are seldom more than a few inches thick. In most places iron is in the form of lenticular concretions, flattened in the direction of the bedding planes. When first formed the concretions were siderite ($FeCO_3$), gray, dense, fine grained, and of homogeneous texture. On weathering the siderite changes to a dark reddish-brown hematite (Fe_2O_3) and light-brown limonite ($2Fe_2O_3.3H_2O$). At one locality (S. ½,

Figure 14.—Concretions (S.½, Secs.34, 35, T.24 N., R.7 E.) along road bank 2 miles west of Calhoun County line and 2 miles north of Grenada County line.

Secs., 34 and 35, T. 24 N., R. 7 E.) 2 miles west of the Calhoun County line and 2 miles north of the Grenada County line, the iron concretions are probably concentrated enough to warrant further investigation (Figure 14).

Sand is very abundant in Yalobusha County as can be seen along almost any road cut or gully. It is used in almost all areas for road building. When applied to roads it will set and become very firm if it contains the proper proportion of clay, and if

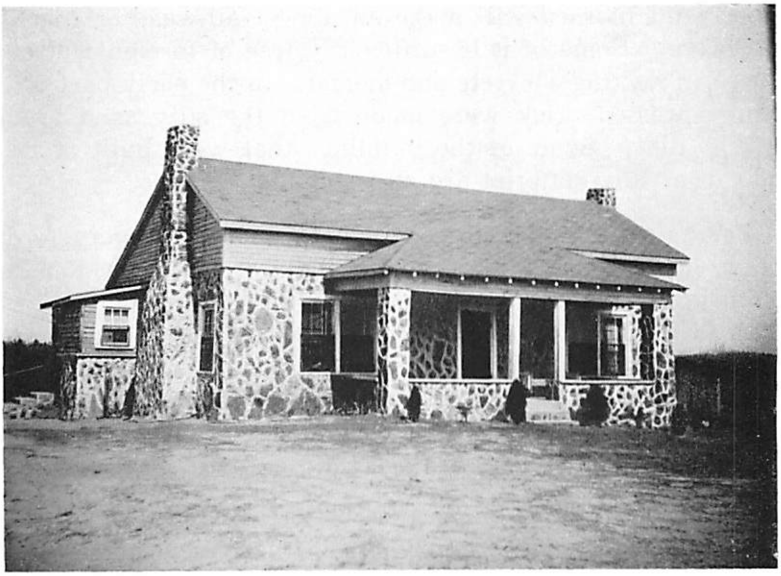

Figure 15.—Native sandstone (NW.¼, Sec.35, T.11 S., R.4 W.) home of Mrs. J. D. Carter. March 14, 1952.

Figure 16.—Massive Kosciusko sandstone (SE.¼, SE.¼, Sec.11, T.11 S., R.5 W.) atop of hill 50 yards north of Highway 32 and 3 miles west of Highway 7. April 17, 1952.

properly maintained will make an almost all-weather road for light travel. Some of it is sufficiently free of foreign matter to be used in making concrete and mortar. In the early part of the century pressed brick were made from the silty sand around Water Valley. Some of the buildings that were built of brick made from this material are still standing.

Ferruginous sandstone is found in practically every formation in Yalobusha County, especially in the Meridian and Kosciusko formations. When properly sized sandstone makes a fair road metal. It is sometimes used as an aggregate in concrete where gravel is not near at hand. Some of the homes built of sandstone are very attractive (Figures 15 and 16). Many other uses are made of sandstone, the commonest of which are: pillars for building chimney bases, flagstones, and steps.

Quartzite in small masses is scattered over the outcrop of the Kosciusko formation. Nowhere in the Kosciusko formation has it been found in place. In some areas it is lying on the outcrop of lower formations, where it has been let down by erosion. In a few small areas quartzitic siltstone of the Ackerman formation has been found in place at the Ackerman-Meridian contact. It is as much as 3 feet thick and tightly cemented in its upper part but becomes less indurated downward. If crushed and sized, a part of this quartzitic siltstone would be good road metal, aggregate for concrete, and ballast for railroads. One of the best exposed outcrops is in an area around Jones School 2 miles south of Gums (common corner, Secs. 1 and 2, T. 23 N., R. 6 E. and Secs. 35 and 36 T. 24 N., R. 6 E.) (Figure 17).

Sand and gravel are exposed in numerous places in a narrow belt along the western border of Yalobusha County. Several pits have been opened and worked spasmodically. At the present time, the only pit known to be in operation is that of Lynn Sand and Gravel Company (Figure 18), which is carrying on an extensive operation of digging, washing, sizing and shipping sand and gravel. Most of the main traveled roads of the county are graveled, those in the western part more especially, because the material is near at hand. In some areas the sand and gravel just as they come from the pits, are free enough of objectionable material and are of proper proportions to be used in making concrete.

Figure 17.—Quartzite at the Ackerman-Meridian contact (SW.¼, Sec.36, T.24 N., R.6 E.) 2 miles south of Gums on a road under construction. April 17, 1952.

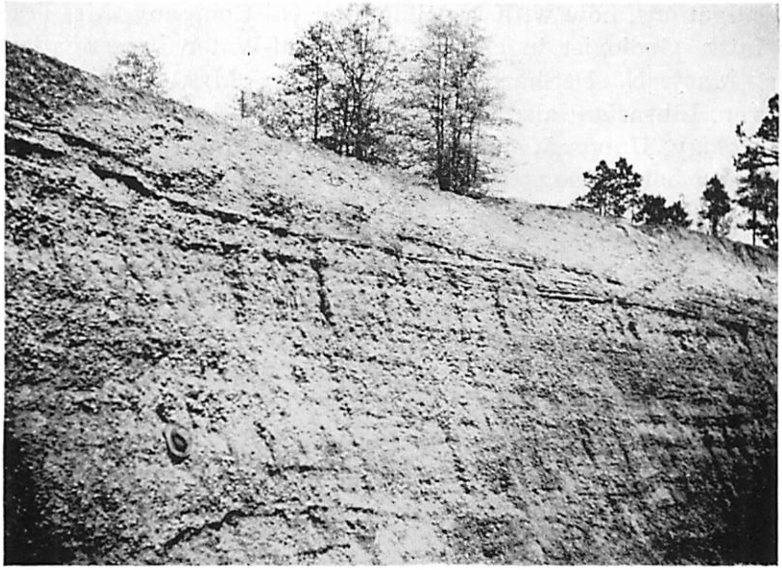

Figure 18.—Pits of Lynn Sand and Gravel Company (Sec.21, T.24 N., R.4 E.) west of U. S. Highway 51, 2 miles north of Grenada County line and 2 miles east of Tallahatchie County line. April 17, 1952.

No extensive study has been made of the soils of Yalobusha County. Generally they are deficient in plant minerals; however, in the lowlands of the rivers and creeks the soil is fertile and supports an abundant growth of vegetation. When the Enid and Grenada Dams are closed, a considerable area of this fertile lowland will be inundated by the back water. In the western part of the county where the soil has been derived from the loess, abundant vegetation flourishes.

According to records of the Mississippi State Geological Survey, 11 test holes have been drilled in search of oil in Yalobusha County. The depth of these wells ranged from 906 to 3,724 feet. Some showings were encountered but none of the wells produced.

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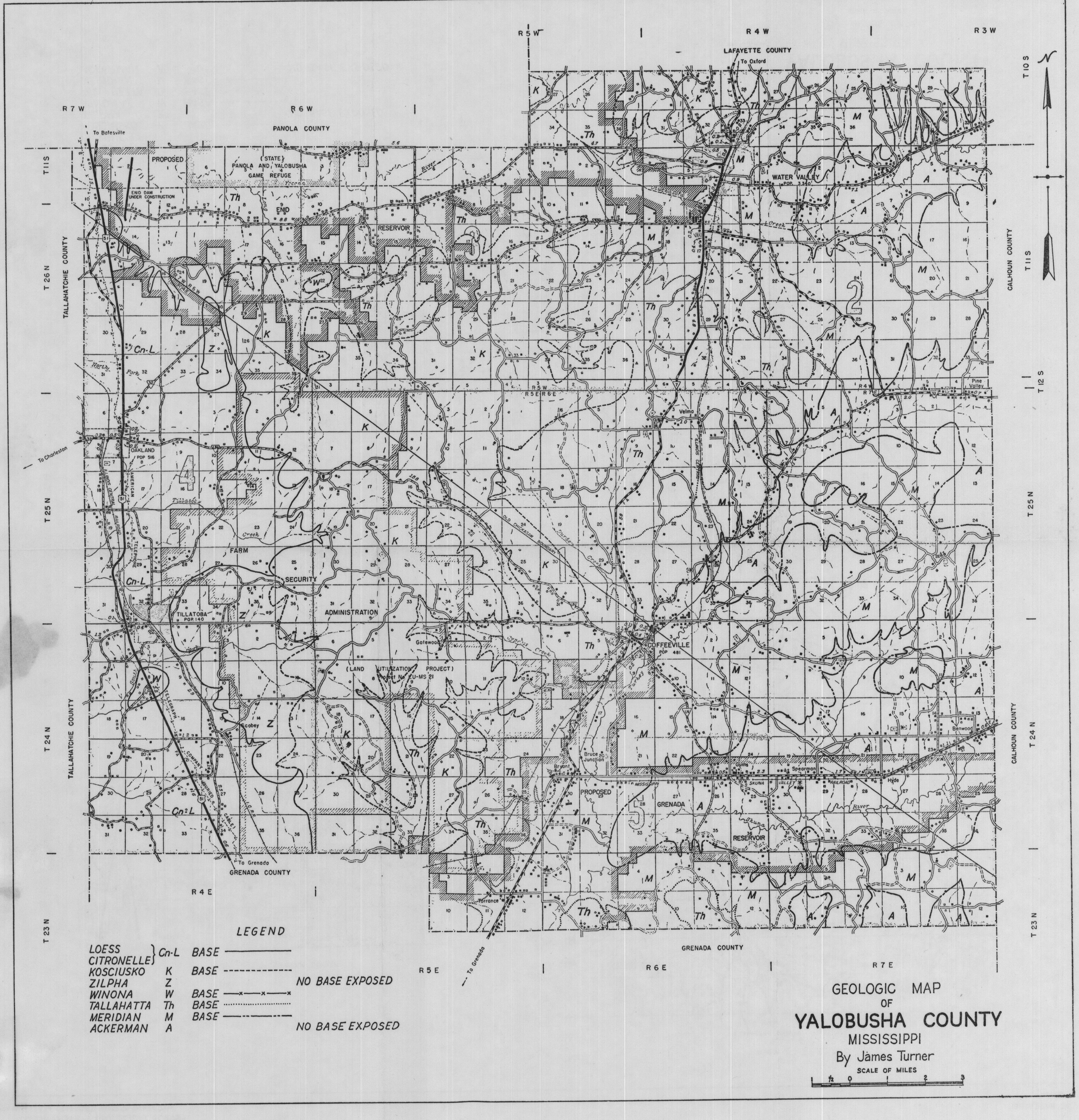
LAFAYETTE COUNTY
PANOLA COUNTY
TALLAHATCHIE COUNTY
CALHOUN COUNTY
GRENADA COUNTY
WATER VALLEY
OAKLAND
TILLATOBA
COFFEEVILLE
ENID DAM UNDER CONSTRUCTION
PROPOSED ENID RESERVOIR
PANOLA AND YALOBUSHA (STATE) GAME REFUGE
FARM SECURITY ADMINISTRATION
(LAND UTILIZATION PROJECT)
PROPOSED GRENADA RESERVOIR
LEGEND
LOESS
CITRONELLE
Cn-L BASE
KOSCIUSKO K BASE
ZILPHA Z NO BASE EXPOSED
WINONA W BASE
TALLAHATTA Th BASE
MERIDIAN M BASE
ACKERMAN A NO BASE EXPOSED
GEOLOGIC MAP OF YALOBUSHA COUNTY MISSISSIPPI
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SCALE OF MILES