Hinds County
Geology and Mineral Resources

WILLIAM H. MOORE

ALVIN R. BICKER, JR.

THOMAS E. McCUTCHEON

WILLIAM S. PARKS

BULLETIN 105

MISSISSIPPI GEOLOGICAL, ECONOMIC AND
TOPOGRAPHICAL SURVEY

FREDERIC FRANCIS MELLEN
DIRECTOR AND STATE GEOLOGIST

JACKSON, MISSISSIPPI
1965

PRICE $3.00

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STATE OF MISSISSIPPI

Hon. Paul B. Johnson	Governor

MISSISSIPPI GEOLOGICAL, ECONOMIC AND TOPOGRAPHICAL SURVEY BOARD

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LETTER OF TRANSMITTAL

Office of the Mississippi Geological, Economic and
Topographical Survey
Jackson, Mississippi

April 15, 1965

Mr. Henry N. Toler, Chairman, and
Members of the Board
Mississippi Geological, Economic & Topographical Survey

Gentlemen:

The staff of the Mississippi Geological Survey has worked diligently to produce this volume. Bulletin 105, "Hinds County Geology and Mineral Resources" is a team effort. No longer is it possible for one or two men to produce a creditable report of this nature on a County of our State. Instead, increasing specialization is required in the synthesis of a scientific report where the data are more abundant and, therefore, more complex, than they were even one decade ago. We have attempted to utilize the talents of our staff members to best advantage in making a geologic report of maximum use to Industry.

I wish to commend not only our capable staff, but also each of the many others who contributed in various ways to the data and data interpretations contained in this Bulletin.

In seeking the attainment of the "Third Plateau" (Commerce), Governor Paul B. Johnson has, by precept and by example, challenged us to "the pursuit of excellence." I am confident that Bulletin 105 has met this challenge, and that in the years ahead Governor Johnson, as well as the Survey Board and Staff, will see great economic growth in Hinds County and throughout Mississippi directly attributable to its publication.

Respectfully submitted,

Frederic F. Mellen
Director and State Geologist

HINDS COUNTY GEOLOGY AND MINERAL RESOURCES

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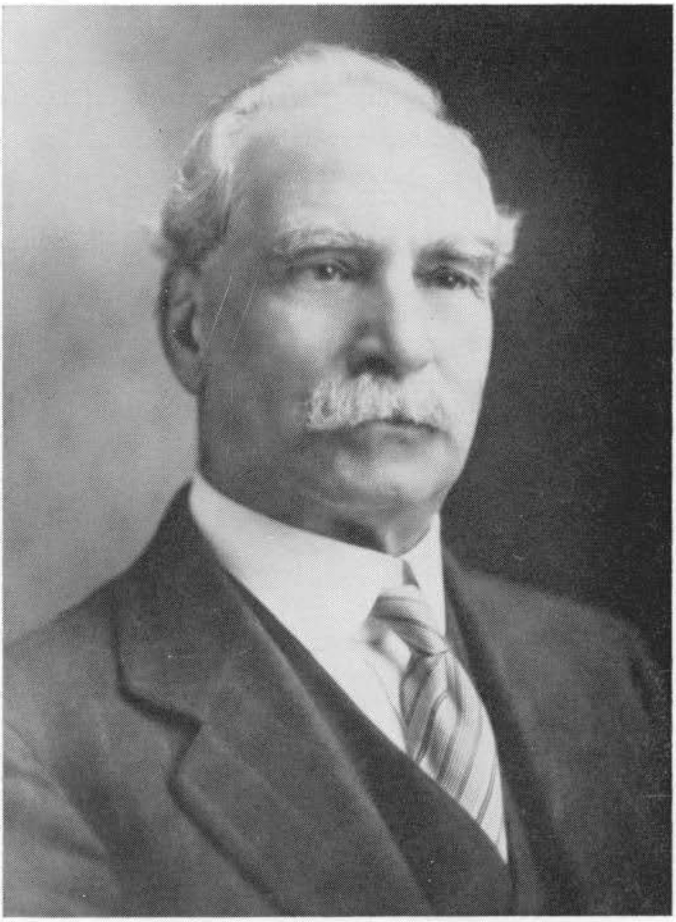

EPHRAIM NOBLE LOWE

May 5, 1864 September 12, 1933

It is fitting to dedicate this report on *Hinds County Geology and Mineral Resources* to the memory of Dr. Ephraim Noble Lowe, born near Utica, who, after a lifetime of service, was returned to his native soil in Bear Creek Cemetery of his home community.

Dr. Lowe served as State Geologist for twenty-four years (1909-1933), was honest, respected, diligent, capable and sincere as a man, as a scientist and as a State official. He is fondly remembered by many Mississippians, but all are beneficiaries of his labors and contributions to the mineral development of our State.

HINDS COUNTY GEOLOGY AND MINERAL RESOURCES

FOREWORD

At its regular quarterly meeting, June 3, 1963, the Board of the Mississippi Geological, Economic & Topographical Survey ordered the Director to commence a detailed survey of the geology and mineral resources of Hinds and Rankin Counties. Although some 30 of the 82 counties of Mississippi had similarly been studied, no comprehensive geologic report on Hinds County or Rankin County had ever been prepared. Both are large Counties: Hinds, with its 877 square miles encompasses 1.83% of the area of Mississippi and with its 187,045 people it contains 8.57% of the State's population; and Rankin County with its 800 square miles is 1.67% of the surface of the State (47,716 square miles) and its 28,400 people constitute 1.57% of the Mississippi populace (2,184,000 in 1960). Hinds County's population density is 213 persons per square mile as compared with 45.8 persons per square mile of the entire State of Mississippi. Its density is growing rapidly as attested by the 1964 estimate of 213,500 people, or 243 persons per square mile.

Useful surveys of mineral resources and county geology are expensive, require much time and technical skill and must have economic justification. The first such county study undertaken by the Mississippi Geological Survey was Winston County in 1937-38. It was encouraged by the GM&O Railroad and by State and Federal planning specialists. It was made possible by WPA grants for the employment of labor, both in the field and in the laboratory. Its economic justifications:

1. To survey "sub-marginal" lands for mineral resources that might form the basis for new industrial employment.
2. To employ workers from certified rolls during the economic "recession" prior to World War II. (About 30 persons were employed in the field and about 25 in the laboratory.)
3. To secure detailed basic knowledge on the geology and resources of the area.

The success of this first project was so notable that the WPA set up a state-wide project to be administered by the Survey.

It also used the work in Mississippi as a pattern for projects in other states of our Nation. Both the laboratory and field work continued with increasing successes until entry of the United States into World War II terminated Federal funds for WPA labor, and effective county studies virtually ceased.

The economic benefits of these county reports showed themselves immediately. High-quality brick and pottery clays of Winston County and adjoining counties were tested and described and this information has, over the years, led to the development of large production of high-grade face brick in the Louisville-Macon-Shuqualak areas. The report on Lauderdale County, including numerous test hole records, geological description, chemical analyses and ceramic tests, is credited by Dickey Clay Manufacturing Company as playing a major part in the establishment of the first B.A.W.I. plant in Meridian, Mississippi. The data reported from the study of Yazoo County led, within 5 months of its publication date (April 12, 1939), to the discovery of Mississippi's first commercial oil production: Tinsley Field is still producing profitably today, after more than 25 years, and, having produced more than 160,000,000 barrels of oil, is still foremost of the three major oil fields of the State. These are some of the outstanding results of the detailed county mineral surveys, but there are more; and there will continue to be more and more as these early reports are studied by new researchers, or as they are re-examined in the light of later supplementing information. These early WPA bulletins are still in great public demand and, despite the fact that the information is "getting older," they do constitute the very best sources of information on the geology and mineral resources of the particular counties.

Some things are self-evident: if geologists do not go out and explore they cannot discover the surficial expression of structures that may be favorable to oil and gas accumulation, nor will they see the half-hidden outcrops of mineral substances that may provide the basis for new industry—for increased employment opportunity in the community. If they do not find these things they cannot report them. If structural evidence or new mineral deposits are not reported they can neither be tested nor developed. One way of expressing this truism is "Nothing ventured, nothing gained." Another way, from the Bible, is more positive: "Seek, and ye shall find."

In undertaking the assignment of the studies of the two counties it was realized that numerous expenses would be incurred outside the approved budget of the Survey. It was also realized that the stage of development of Hinds and Rankin Counties was such that unprecedented opportunities were to be found in the collection and assimilation of data developed in various ways. Since the description of the Jackson Dome by Hilgard in 1860 a crescendo of geological interest and exploratory effort had produced, by 1963, creditable mineral industries in both Hinds and Rankin Counties. This effort has produced a mass of geological data never before available in a county study.

Of one thing the Director has been insistent: Where so many people are vitally concerned with the mineral resources no sacrifice of quality can be tolerated. Moreover, other State Geological Surveys—of 45 other states—are competing with us for a limited supply of mineral industries. Oklahoma, for example, under Dr. Carl Branson, is currently publishing county reports at a rate and of such high quality as to provide keen competition in the market of mineral industries. Government-sponsored stockpiling of strategic minerals has forced many domestic mines to shut down; recent revisions of international trade policies have caused concern and alarm throughout the mineral producers of the United States and have been a major deterrent to the establishment of new plants or the expansion of old ones.

In the organization of the present assignment, the Director took his problem of additional support to some of the larger industrial leaders of the area. In turn, the matter was referred to the Central Mississippi Industrial Development Council, the Industrial Development Committee of the Jackson Chamber of Commerce and finally to the Hinds County Board of Supervisors which agreed to contribute, and has contributed, $7,500 support to the estimated cost to the Survey of $37,500, making a total approximate cost of $45,000 for the work and publication of Bulletin 105. This cost is less than 23¢ for each person in Hinds County. The benefits will ultimately be many, many times the cost.

The Director, with the approval of the Board, assigned William H. Moore, Stratigraphic Geologist, as principal investigator responsible for the overall satisfactory execution of the Hinds County study and for the specific duties of field geological work and sampling. William S. Parks, Economic Geologist, has prepared the part on mineral industries. Alvin R. Bicker, Subsurface Geologist, employed in June, 1964, has been in charge of preparing the series of highly valuable subsurface structural and isopachous maps as well as the discussion to accompany these maps. Dudley Hamm, Driller, has played an important part in the execution of the project. Recently employed Wilbur Baughman, Assistant Geologist, has contributed in numerous ways to the total effort. T. E. McCutcheon, Consulting Ceramic Engineer, was low bidder on ceramic testing of the 22 samples of clays selected by Moore as representative. McCutcheon has also prepared the section of the report dealing with some of the possible commercial uses of these clays. The Survey employed Shilstone Testing Laboratory to make chemical analyses of 22 clay samples and the Mississippi Testing Laboratory to make screen analyses on samples of gravel. The Mississippi State Highway Department has been of great assistance in various ways: 1) in the providing of base maps, 2) in the furnishing of drill logs, profiles and other related near-surface data, and 3) in supplying information on sand and gravel pits—locations and grade classifications. Mercury Maps was employed in the cartographic execution of the surface and subsurface geologic work.

The Mississippi State Chemical Laboratory, through the cooperation of State Chemist, Dr. M. P. Etheredge, and Mr. B. W. Patterson furnished six complete representative analyses of Vicksburg limestones and marls and detailed $CaCO_3$ determinations on a suite of cores from basal Yazoo clay in test hole AF-17.

Two clay industries, in competitive fields, have conducted their specialized tests on some of our samples and have, in confidence, furnished their results to us for inclusion in this report. They, for the first time, now know from whence these samples came. In fact, all of the minerals industries of Hinds County have been exceedingly generous with their information and cooperative with the Survey in every way.

Landowners have, at all times, assisted and indulged the Survey's exploratory efforts. All public officials, too, have been cooperative.

One of the most valuable sources of information has been the hundreds of electrical logs of core holes and water wells supplied to us by the many oil companies and operators and by the Ground Water Division, U.S.G.S. These data were secured at the probable cost of several million dollars. Having much of these data early precluded the drilling of unnecessary holes by the Survey, thus saving the State a great deal in time and money. As Moore will summarize, the Survey, itself, drilled and/or cored 63 test holes, totaling 11,408 feet. This, in itself, is a major contribution to the shallow geology of Hinds County. The mapping of these data by Bicker has resulted in what is probably the most valuable and useful set of maps ever prepared for a Mississippi county. These hundreds of logs (with the exception of only a few received on a "confidential" basis) will be available in the Survey's open files upon publication of Bulletin 105.

Thus has come about a development of one of the Survey's most important functions, to serve as a repository for, and source of information on, the mineral natural resources of the State, oil and gas, waters, and the "hard" minerals. Intensified study of a county is the most effective and quickest way to bring about the collection of all available data on a county. When this has been done, supplementation of the files is relatively simple and inexpensive.

Although the motivation has been economic, the study of Hinds County has provided opportunity for academic researches which will, in time, contribute to the State's economy. Hinds County contains "type localities" of some well-known geologic units. In the field work these localities were cored and studied very completely. Materials from these cores are being utilized by numerous graduate students in outstanding geological schools of the Nation. The results of these studies will be available to the Survey. This facet of the Hinds County work was described in Bulletin 104, *Mississippi Geologic Research Papers,* 1964 in an article "Type Localities Sampling Program," by Moore, Parks and Kern.

Geologic knowledge is accrual. Each decade brings new data at an ever-increasing exponential rate. In realizing the enormousness of a "complete study of the geology of Hinds and Rankin County" and the very practical aspect of releasing a part of the work at an early date, the present form of Bulletin 105 took shape. Although considerable work has been done in Rankin County it has been decided best to suspend that part of the study until the first basic part of the Hinds County portion, Bulletin 105, has been completed. Also, the Survey is greatly handicapped in the southeastern quarter of Rankin County by the absence of topographic maps. The Director has been informed that, upon nomination by him and strong support from other sources, the Cato and Shongelo quadrangles have been included in the program for mapping. Therefore, much may be gained by a short delay in the Rankin County program.

As it is now appearing, Bulletin 105 covers the geology and mineral resources of Hinds County down to the base of the Midway shale. Thus, it does not concern itself with the deep and complicated geology of the "Gas Rock" and underlying rocks; nor is it primarily concerned with petroleum geology, even though some of the shallow structural features will, eventually, help point the way to new deeply-buried oil or gas deposits.

As presently conceived, the completion of the assignment of the Survey Board made June 3, 1963, will necessitate two additional bulletins:

1. Geology and mineral resources of Rankin County (down to the base of the Midway shale); and
2. Pre-Porters Creek structure and stratigraphy of the Jackson Dome. (This would involve many months of lithologic, petrographic, paleontologic and structural study of deep well logs, cores and cuttings of hundreds of deep oil test wells in Hinds and Rankin Counties and parts of Madison and Yazoo Counties.)

As thus outlined, part one of this ambitious trilogy will have been completed by concerted, cooperative and diligent team effort in exactly two years from the date of assignment.

The "Jackson Gas Rock," lying below the Midway shale, is one of the largest and least understood masses of reef limestone in the Gulf Coast Region. It ranges in thickness to a maximum well over 1000 feet, and, though it lies between the Midway shale (Porters Creek) and the "normal" Selma chalk of Taylor age, opinion continues to be divided as to its age—whether all

Cretaceous, all Midway, or part Cretaceous and part Midway, possibly bridging the time interval elsewhere in the State marked by erosional unconformity.

Nineteen sixty-four and 1965 have seen numerous "Gas Rock" tests, many of which have recovered cores. This unusually active exploration has been caused by profitable oil production from a sand reservoir in the upper "Gas Rock" in the Flora Oil Field of Madison County. The Survey is saving all of the cores it can get from these wells for the purpose of present and future research study. Micro- and macro-fossils, and fossil pollen and spores from the "Gas Rock" will throw light on the mode of development, age and other features of this important geologic unit. Insoluble residue studies of these carbonate cores in a properly supervised program of research will throw light on the source of these residues and, among other possibilities, may aid in the discovery of oil-filled sand reservoirs enclosed as stratigraphic traps. At no time in the past have so many "Gas Rock" tests been drilled and cored, and never before has such a wealth of research material been yielded from these sediments. The Survey is anxious to continue adding to this collection which will be shared with competent research geologists. Such data will be of great help in future studies of the deeper subsurface geology of the Jackson Dome Area.

Bulletin 105, *Hinds County Geology and Mineral Resources* by Moore and others may have numerous minor technical limitations. We do, however, believe that it is a major scientific contribution to the mineral economics of Mississippi and the Nation and that the bulletin itself will be an object for emulation by, and inspiration of, the Geological Surveys of Mississippi's competing sister states.

Frederic F. Mellen
Director and State Geologist

February 1965

HINDS COUNTY GEOLOGY

WILLIAM H. MOORE

ABSTRACT

Hinds County, located just southwest of the center of the State, lies within the parallels 32° 00′ and 32° 35′ north latitude and the meridians 90° 00′ and 90° 45′ west longitude. It is within the Gulf Coastal Plain physiographic province.

The bedrock strata exposed are part of the Eocene, Oligocene and Miocene series of the Tertiary system. The units in ascending order are the Cockfield formation of the Claiborne group, the Moodys Branch and Yazoo formations of the Jackson group of Eocene age; the Forest Hill formation and the Vicksburg group of Oligocene age; and the Catahoula formation of Miocene age. These units are overlain locally by deposits of Citronelle gravel, pre-loess terrace sands and gravels, and loess.

The major structural feature in Hinds County is the Jackson Dome located in the northeastern portion of the County. Six salt domes are present in the subsurface of the County. Strata found at higher than normal position indicate smaller structural features in two localities. One is in the northwestern portion of the County in T.7N., R.4W., and the other just west of the Oakley Salt Dome T.5N., R.3W.

Surface rocks and minerals of possible economic importance include clay and natural clay mixtures, sand and gravel, and limestone and marl. The clays are being used or may be used in brick manufacture, production of lightweight aggregate, foundry bond clay and bleaching clay. Sand and gravel are utilized in road and highway construction and in the building industry. Limestone and marl may be used in the production of cement, rock wool, and agricultural lime.

INTRODUCTION

The field work for the present investigation began in late July, 1963, and the last test hole was drilled February 2, 1965. The investigation consisted of a study of the character, distribution and thickness of the various geological units and the surface structures which affected these units. In addition to stratigraphic and paleontological considerations, especial attention was given a search for materials of possible economic importance. A total of 63 test holes was drilled in order to gain stratigraphic and structural information and to obtain samples for various laboratory tests and paleontological and palynological studies. Footage drilled and cored totaled 11,408 feet. The holes were drilled with the Survey's Failing 750 rig and logs were run on many of them with the Survey's Widco electrical logger and its new Neltronic

2K logger which is equipped to make gamma-ray logs in addition to the conventional two curve electrical log.

In addition to data obtained by holes drilled by the Survey, the investigation of the geology and mineral resources of Hinds County was greatly helped by the wealth of information obtained from the many logs of core holes and water wells supplied to the Survey by oil companies, operators and the Groundwater Division U. S. G. S. This information saved time and money by allowing the Survey to spot more advantageously its tests and eliminate unnecessary holes.

PREVIOUS INVESTIGATIONS

Although no comprehensive geologic report on Hinds County has been prepared, certain portions of the County and particular formations, fossil suites and specific mineral resources have been the subject of previous investigations.

Wailes[1] in 1854 and Harper[2] in 1857 made mention of the strata in Hinds County in their reports on the geology and agriculture of the State. These early reports of the Mississippi Geological Survey were followed by the classic report on the geology and agriculture of Mississippi by E. W. Hilgard[3] in 1860. Hilgard discussed several formations found in Hinds County and recognized a structural anomaly at Jackson as he commented, "At Canton we find the highest strata apparently of the Jackson Group—the gray calcareous clay matrix of the *Zeuglodon,* occupying the surface, though at a moderate depth (20 to 30 feet) the lignito-gypseous material is struck, yielding undrinkable water. The same strata are seen all the way between Canton and Jackson, and crop out very characteristically half a mile N. of the State House. Yet we find lignitic strata cropping out on Moodys Branch, a mile N.E. of the State House, and that at a hypsometrical level obviously higher, than that at which, a mile below, we find the beds of blue fossiliferous sand cropping out on Pearl River and in the bed of Dry Creek. Making due allowance for the undulations of the surface at both stations (Canton and Jackson), the surface of the lignitic strata, so far from exhibiting a southward dip, is still higher at Jackson than at Canton. It seems difficult to account for this condition of things unless by supposing a local upheaval of the underlying formation to have taken place before the deposition of the lowest of the Jackson stage." Thus Hilgard, through his thorough and systematic investigations pointed out a surface expression of the now widely known Jackson Dome.

Langdon[4] in 1886 made mention of studies along the Pearl River between Jackson and Byram in his work on the Tertiary of Mississippi and Alabama.

Crider[5] in 1906 reviewed the geology in Hinds County and gave additional data on the Vicksburg limestones and marls in his work on cement and Portland cement materials in Mississippi in 1907.[6] The same year Logan[7] described brick clays in the Jackson area.

Lowe[8] in 1915 summarized the geology of Mississippi, made mention of thickness of formations in Hinds County and proposed some new names for some of the strata found in the County. Later works by Lowe in 1919[9] and 1925[10] made minor corrections on his 1915 work.

Dr. Lowe was a native of Hinds County. He is buried in the cemetery at Bear Creek Church just south of State Highway 27 (Sec.33, T.3N., R.3W.) about 7 miles southeast of Utica. Dr. Lowe served as State Geologist for 24 years and it seems an appropriate tribute to this illustrious native Hinds Countian to include a picture of his gravestone in the Hinds County bulletin (Figure 1) and to dedicate this work in his memory.

In 1916 Hopkins[11] worked in the Vicksburg and Jackson area and published a structural contour map with the top of the Vicksburg limestone as the datum. Hopkins recommended the Jackson anticline as a favorable area to drill for oil and gas. Lowe[12] had suggested this in his 1915 publication, but it was not until Hopkins' report was released that drilling began in earnest on the Jackson Structure. After the drilling of two unsuccessful holes north of Jackson, Lowe[13] was able to show that these wells had been drilled too low on the structure as it is expressed by the surface outcrops.

Cooke[14] in 1918 reviewed the stratigraphy of the Jackson and Vicksburg groups and made several changes in the nomenclature. His statements and ideas on these rocks will be discussed in the section on stratigraphy.

Figure 1.—Gravestone of Dr. E. N. Lowe in cemetery of Bear Creek Church (Sec.33, T.3N., R.3W.) about 7 miles southeast of Utica. Perry Nations photo. March 26, 1965.

Grim[15] in 1928 discussed the recent oil and gas prospecting in Mississippi and made a study of the subsurface geology. He concluded that the Jackson anticline was the result of crustal movement but thought that the structure was due to faulting.

After the discovery of the Jackson Gas Field in 1930, Monroe[16] in 1932 described the geology of the field down to and including the producing horizon, the Jackson "Gas Rock." In his 1933 paper, Monroe[17] described the rocks below the "Gas Rock." A history of the Jackson Gas Field and descriptions of the rocks from the State Fee No. 2 well by Monroe and Toler[18] was published in 1937. A summary of the geology and the production of the Jackson Field by Munroe[19] was published in 1935.

Several reports were published on specific mineral resources or detailed studies were published later such as Bay[20] in 1935 on the possibility of bentonitic clays in the Yazoo of Hinds County, Grim[21] in 1936 on mechanical analysis and petrographic studies of the Moodys Branch, the Yazoo clay and the Forest Hill, and Mellen[22] in 1942 on the agricultural limestone possibilities in the County.

Monroe[23] in 1954 published on the geology of the Jackson area. His report covered the northeastern portion of Hinds County and portions of several other counties. He gave the most complete summary of the geology of this area to date. This report included a geologic map which made use of the topographic coverage available at that time. The present writer found Monroe's geologic map of the portion of Hinds County covered to be quite accurate.

From 1958 to 1964 the Groundwater Division of the United States Geological Survey released several reports on the groundwater resources of the Jackson area and Hinds County. A more complete reference to these reports will be found in the section "Hinds County Water Resources."

There have been over the years several reports on the paleontology of formations found in Hinds County and several Masters' thesis on this subject. There also have been sections of two of the latest bulletins published by the Mississippi Geological Survey dealing with aspects of Hinds County Geology. These are Bulletin 101 of the Survey on lightweight aggregate materials by Parks[24] and others, and the section in Bulletin 104 on the type localities sampling program by Moore, Parks and Kern[25] and the section by Donald Englehardt[26] on palynology of the Cockfield formation.

DESCRIPTION OF THE AREA

LOCATION AND SIZE

Hinds County is located just southwest of the center of the State. It lies within the parallels 32° 00′ and 32° 35′ north latitude and the meridians 90° 00′ and 90° 45′ west longitude. The southern boundary of the County is straight but the other bound-

Figure 2.—Location of Hinds County.

aries are irregular. The eastern boundary is marked by the Pearl River; part of the western boundary is the Big Black River and the northern boundary has several offsets. Hinds County has a maximum east-west extent of 39 miles and a maximum north-south extent of 37 miles. The area of Hinds County is 877 square miles, or 561,280 acres. Hinds County is bounded on the north by Madison and Yazoo Counties, on the east by Rankin County, on the south by Copiah County and on the west by Claiborne and Warren Counties (Figure 2). Jackson and Raymond are the County Seats and Jackson is also the State Capitol.

POPULATION

The 1960 census shows a population of 187,045 for Hinds County. This is an increase of 31.5 percent from the 1950 census figure. Of the total, 60.7 percent are white, 39.2 percent are negro and 0.1 percent are classed as other races.

Hinds County has a population density of 213.3 persons per square mile, but this figure is somewhat misleading as most of the population is concentrated in or near Jackson. The 1960 census gives Jackson a population of 144,422. This figure is up 47.0% from the 1950 census. Some of this growth is from annexation of additional area by the City of Jackson, but a major portion of the population in these annexed areas is new to the County.

Incorporated towns, other than Jackson, are Bolton (pop. 797), Clinton (pop. 3,438), Edwards (pop. 1206), Learned (pop. 96), Raymond (pop. 1381), Terry (pop. 585), and Utica (pop. 764). Small villages and communities shown on the general highway map are Adams Station, Brownsville, Byram, Carmichael, Cayuga, Forest Hill, Lebanon, Morning Star, Newman, Mount Moriah, Oakley, Pocahontas, Queens Hill, Seven Springs and Tougaloo.

CLIMATE

Climatological data for Hinds County for a 10-year period July, 1954, through June, 1964, are shown in Table 1. The County has a warm, temperate climate, characterized by long summers and short, mild winters. Below freezing temperatures and snowfalls are infrequent. The highest temperature recorded was 105 degrees in August and the lowest was 1 degree below zero in January, but extreme temperatures approaching these are rare. The annual precipitation is fairly well distributed with rainfall being greatest during winter and spring and least during summer and fall. The growing season is long with the average being about seven months from the end of March to the first of November.

Table 1

Normal, Monthly, Seasonal, and Annual Temperature and Precipitation at Jackson, Hinds County, Mississippi*

Month	Temperature			Precipitation		
	Average	Absolute maximum	Absolute minimum	Average	Absolute maximum	Absolute minimum
	F°	F°	F°	Inches	Inches	Inches
December	48.4	83	8	4.60	11.16	2.27
January	44.0	80	-1	4.35	7.06	2.13
February	49.5	84	10	4.26	7.44	2.32
Winter	47.3	84	-1	13.21	25.66	6.72
March	55.4	86	21	5.54	10.92	1.93
April	65.0	90	33	5.25	11.88	1.46
May	73.6	99	42	3.51	5.18	1.47
Spring	64.7	99	21	14.30	27.98	4.86
June	78.4	101	48	3.51	5.18	1.47
July	81.7	104	63	5.09	13.13	1.09
August	81.2	105	54	3.29	10.23	.52
Summer	80.4	105	48	11.89	28.54	3.08
September	76.5	97	46	3.23	8.30	.04
October	66.1	96	26	2.05	4.18	.00
November	55.6	86	20	4.01	9.78	1.55
Fall	66.1	97	20	9.29	22.26	1.59
Year	64.6	105	-1	48.69	104.44	16.25

*Average temperature and precipitation based on a 10 year record; compiled from available recordings in U. S. Department of Commerce, Weather Bureau, "Climatological Data," July, 1954, through June, 1964.

CULTURE AND INDUSTRY

The 1960 census shows a total employed labor force for Hinds County of 70,705. This is broken down into 42,939 employed males and 27,766 employed females.

Hinds County is divided into two main cultural areas. One is the highly industrialized and heavily populated metropolitan Jackson area; the other is the mainly agricultural area of the remainder of the County. As a whole, the County is quite industrialized. This fact is demonstrated by employment figures showing 5,293 male professional workers and 3,880 female professional workers along with 7,154 male craftsmen and 2,083 female factory workers. This is in comparison to 1,662 male farmers and 202 female farmers. Of course, several industries depend on farm products in their operation.

The principal sources of farm income are livestock (beef cattle and hogs), poultry, dairying, cotton and grain crops. Lumbering is not as important an industry in Hinds County as in other counties of the State but several industries depend on lumber in their manufacturing operations.

There are approximately 240 manufacturing plants in Hinds County. All but a few of these industries are located in Jackson. The most prominent manufactured products are wooden cabinets for television and radio, kitchen appliances, light bulbs, truck bodies, brooms, newspapers and printed matter, baked goods, meat products, bottled drinks and clothing. The Hinds County industries using or producing mineral products will be discussed in the section on mineral industries.

ACCESSIBILITY

A good system of Federal, State and County highways and roads makes most of Hinds County readily accessible. Interstate Highway 55 crosses the eastern portion of the County in an essentially north-south direction, passing through Jackson. Interstate 55 is paralleled most of its distance in Hinds County by U. S. 51. Interstate 20 is being built parallel to U. S. 80 and crosses the County east to west. The two Interstate highways, U. S. 51 and 80, are concrete surfaced.

State Highway 18 extends from Jackson southwesterly through Raymond and Utica in Hinds County to Port Gibson in Claiborne County. Highway 18 is asphalt and concrete surfaced. State Highway 467 extends from Raymond northwest to Edwards and is asphalt surfaced. State Highway 27 crosses the southwestern portion of the County and is asphalt surfaced. State

Highway 22 runs from Edwards northeast through Brownsville to Flora in Madison County and is asphalt surfaced in part. The unpaved portion of Highway 22 will be asphalt surfaced in 1965.

There are some 900 miles of county roads with more than half being asphalt surfaced. This insures good farm-to-market roads in almost all parts of the County. The remainder of the county roads are gravel or sand surfaced and are generally well graded and drained. These roads are passable at all times except for prolonged periods of wet weather and occasional bridge washouts. Some portions of the County adjacent to the Pearl River on the east and the Big Black River on the west cannot readily be reached from other counties and vice-versa due to the lack of bridges crossing these rivers.

In addition to the Federal, State and County roads, the City of Jackson maintains some 490 miles of streets with all but a few miles being concrete or asphalt surfaced.

The route of the historic Natchez Trace crosses Hinds County from southwest to northeast. A segment of the Trace has been cleared and asphalt surfaced from a point just south of Rocky Springs in Claiborne County to Morning Star in Hinds County. This segment will be connected in the near future with the already completed portions of the Trace to the southwest and northeast.

Several rail lines cross Hinds County, all passing through Jackson. The main line of the Illinois Central Railroad from New Orleans to Chicago travels along the eastern edge of the County. Branch lines of the Illinois Central extend from Jackson, going northwest to Yazoo City and points north; west through Clinton, Bolton and Edwards to Vicksburg; southwest through Raymond and Utica to Natchez; and southeast to Hattiesburg and the Gulf Coast. The Gulf-Mobile and Ohio Railroad passes through the southeastern portion of the County, running south to Monticello, Columbia and points in Louisiana. The Gulf-Mobile and Ohio also goes east across the Pearl River at Jackson, branches and proceeds to Meridian by two routes.

The Jackson area is served by several commercial air lines, linking Jackson with all parts of the country.

GEOMORPHOLOGY

TOPOGRAPHY

The surface work on the geological survey of Hinds County was aided immeasurably by complete topographic map coverage (Figure 3). The older maps are 15 minute quadrangles with a scale of 1 to 62,500 and a contour interval of 20 feet. These older

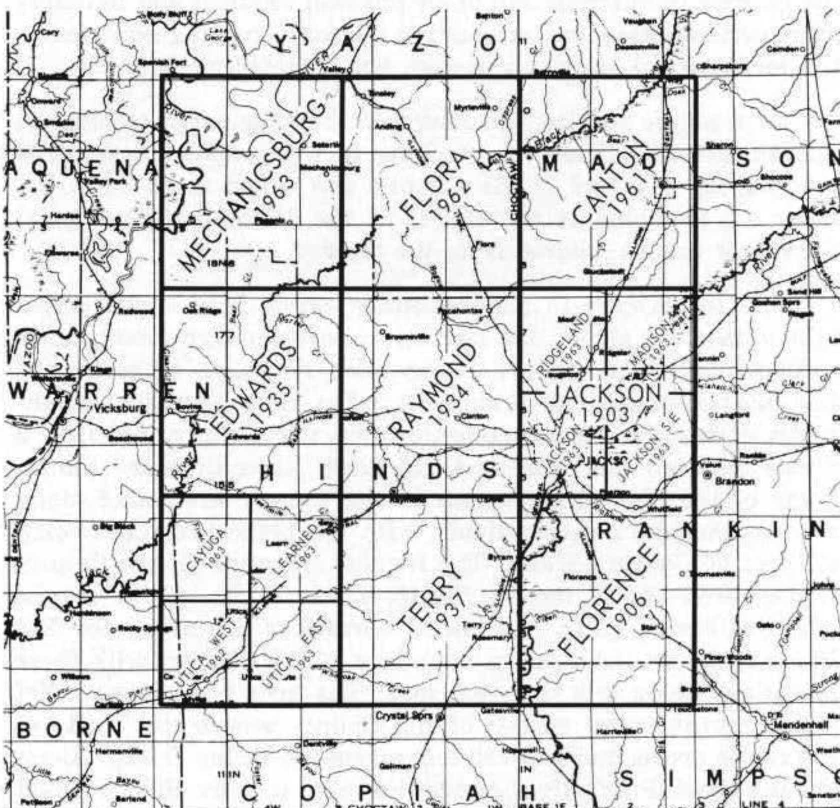

Figure 3.—Topographic map coverage of Hinds County.

maps include the Florence quadrangle, mapped in 1906; the Raymond quadrangle, 1934; Edwards, 1935 and Terry, 1937. Small portions of the northwestern corner of the County lie in the Flora and Mechanicsburg quadrangles which were mapped in 1963 and 1962 respectively as 15 minute quadrangles. The Jackson quadrangle was issued in the 15 minute series in 1903 but was remapped in 1963 as four 7.5 minute quadrangles. These maps are on a scale of 1 to 24,000 and have a 10-foot contour interval with 5-foot contours in the flat alluvial plains. Utica West, 1962, and Utica East, Cayuga and Learned, 1963, were mapped in the 7.5 minute series. The availability of these maps enables the geologist to get a better picture of the overall topography of the County, to locate quickly and accurately on maps the position of outcrops and other physical features and to determine, without the time consuming use of surveying equipment, the location and elevation of core holes, water wells, etc.

As a public service, the Board of the Mississippi Geological Survey has authorized the stocking of topographic maps. The topographic maps of Hinds County and other maps over the State are available at the offices of the Mississippi Geological Survey or can be ordered from the Survey.

The topography in Hinds County varies from high rugged hills with steep slopes and narrow valleys through lower, more rolling hills, wider valleys and gentler slopes, to rather broad flat alluvial plains. A prominent ridge runs generally north-south across the eastern one-third of the County, forming a divide between the Pearl and Big Black River drainage basins. Some of the highest elevations in the County are found along the southern part of this divide, with the highest of these being 473 feet at Coopers Wells. The highest elevation in the County is measured at 488 feet in Sec.15, T.5N., R.1W., about a mile north of Forest Hill. The lowest elevations are along the Big Black River on the western boundary of the County, with these elevations being less than 100 feet. The area of greatest relief is the southwestern corner of the County where the crests of the ridges are as much as 200 feet above the valley floors. Along the Big Black-Pearl River divide the relief is as much as 150 feet with the western slope of the divide being somewhat steeper than the eastern slope.

The most prominent alluvial plains are of course those of the Big Black and Pearl Rivers and are as much as three miles in width. However, these rivers form parts of the boundaries of the County and a portion of these alluvial plains are in other counties. The alluvial plains of Tallahala, White Oak and Fourteen Mile Creeks are one and one-half miles wide in some places with Bakers Creek, Bogue Chitto Creek and some others having plains almost as wide.

DRAINAGE

Hinds County is within two major drainage basins — the Pearl River and the Big Black River. As stated previously, the divide that separates these basins runs north-south through the eastern one-third of the County. The drainage of the northern end of the divide is affected by the prominent structural feature, the Jackson Dome, which causes some of the streams in the northeastern corner of the County to flow north into the Big Black. The effects of the Jackson Dome and the position of the divide restrict the Pearl River drainage basin to a much smaller portion of the County than that occupied by the Big Black basin. In addition to these two major drainage basins, two large creeks in the south-central and southwestern portions of the County, Tallahala and White Oak Creeks join and flow southwesterly into Copiah County where they join Bayou Pierre and flow westward into the Mississippi River.

Hanging Moss Creek, Lynch Creek, Carey Creek and several smaller creeks drain the area in and around the City of Jackson and are tributaries of the Pearl. South of Jackson, Trahon, Big Rhodes and Beaverdam Creeks and their tributaries flow eastward into the Pearl.

Bogue Chitto Creek and its tributaries, Lime Kiln and Straight Fence Creeks, drain the area northwest of Jackson and flow north across Madison County to the Big Black River.

Five Mile Creek and Fourteen Mile Creek, along with the large tributary Bakers Creek, drain west-central and western Hinds County and flow into the Big Black. The northwestern corner of the County is drained by Porter Creek and its tributaries and by Bayou Fibia Creek, both major creeks flowing into the Big Black River.

GEOMORPHOLOGY OF STRUCTURAL FEATURES

Portions of Hinds County lie in three of the ten physiographic regions of Mississippi as defined by Lowe.[27]

The northeastern portion of the County is in the Jackson Prairie region and is characterized by gently rolling country.

The Jackson Prairie topography is developed on the thick and extensive Yazoo clay. Some of the higher hills in the Prairie belt are capped with terrace deposits of sand and/or gravel. These terrace deposits and the Yazoo clay are in many places covered with brown loam, a weathering product of the loess.

To the west, southwest and south of the Jackson Prairie belt is the physiographic region called by Lowe[28] the Long Leaf Pine Hills and now commonly known as the Southern Pine Hills. At the northern and eastern edges of this region is an abrupt scarp. This is usually characterized by a steep slope at the contact of the Yazoo clay and the Forest Hill formation, and a more gentle back slope over the outcrop of the Forest Hill and the overlying Vicksburg group. This portion of the Southern Pine Hills region is treated by Priddy[29] and others as a separate physiographic region called the Vicksburg Hills.

The southern portion of the Pine Hills region of Hinds County is underlain by the Catahoula formation. Some of the higher hills are capped by pre-loess terrace deposits and the highest ones by deposits of Citronelle gravel. The brown loam blankets most of this area.

The third physiographic region in the County is the Loess or Bluff Hills. These hills are developed on deposits of loess up to 30 feet overlying the Catahoula formation, the Vicksburg group and in a few places, the Forest Hill formation. The Loess Hills are characterized by rugged topography with vertical bluffs of loess along road cuts and streams. Where pre-loess terrace deposits overlie the Catahoula formation and are in turn overlain by the loess, an especially rugged topography results. This is true of the southwestern corner of the County, an area of great relief known locally as the Scutchalo Hills.

The physiographic regions in the County have been modified in some areas by the influence of structural conditions. The greatest structural influence is, of course, the Jackson Dome. This feature was observed by Hilgard[30] more than one hundred years ago when he found beds of the Cockfield formation at Jackson, a point much farther south than would have normally been expected. The uplift on the Jackson Dome causes many square miles of Hinds County to fall in the outcrop area of the Moodys Branch marl and the Yazoo clay. Were the structural conditions at Jackson normal, with regional dip prevailing, the outcrop belt of the Yazoo clay, the Moodys Branch marl and the Cockfield formation would lie north of Hinds County.

The Dome has been breached by the Pearl River which now flows over some of the highest structural points on the Dome. The structurally high portions of the Dome on the Hinds County side of the Pearl River are in the outcrop area of the Yazoo clay, and to a small extent the Moodys Branch and Cockfield formations, which are easily eroded and are now topographically lower than Forest Hill cuesta. This cuesta is highest topographically on the steeply dipping southwestern flank of the structure and is somewhat more subdued on the western flank. Outliers of the Forest Hill formation and the Vicksburg group in Township 7 North, Range 1 West in Hinds County and in 7 North, 1 East in Madison County lie in the rim syncline on the north flank of the Dome.

There are six salt domes present in the subsurface of Hinds County. The structural features of these domes are fully discussed in the section "Hinds County Structural Geology." The top of the salt mass is at 2900 feet or below in these domes and although the beds at or near the surface are affected over some of the domes it is difficult to detect any topographic expression of the uplifts.

In the area of the Brownsville Dome in Township 7 North, Range 2 West, the Glendon limestone which outcrops here is structurally high. There is a somewhat subdued divide present over the dome between the drainage area of Bogue Chitto Creek on the east and Bogue Fibia Creek on the west. There are other divides between creek basins in the area and this particular one would probably not be noted were the existence of the Brownsville Dome not known.

The Halifax Dome in Township 7 North, Range 4 West is in an area of thick loess deposits covering the bedrock and masking any surface indication of the Dome should it be present.

The Edwards Dome, about one mile east of the town of Edwards, is in the area covered by the alluvial plain of Bakers Creek and is indistinguishable on the surface. The Learned Dome in Township 5 North, Range 4 West and the Oakley Dome, Township 5 North, Range 4 West are in the alluvial plain of Fourteen Mile Creek and, while the uplift on these domes is known to affect beds as young as the Vicksburg group, no topographic expression is seen.

The Carmichael Dome in Township 3 North, Range 3 West is structurally high on the Glendon limestone of the Vicksburg group, and the area over the Dome is topographically high. The surface rocks are the Catahoula formation with the hill being topped by a deposit of terrace sand and gravel, and it might be the resistance of these rocks to erosion rather than structural conditions that causes this topographic high.

The lack of structural uplift would seem to be a plausible explanation for a surface feature found along the Big Black River. Just west of the town of Edwards in Townships 6 and 16 North and Ranges 4 West and 5 East, the Big Black changes its course from a southward flowing stream and for a distance of five miles flows west and west-northwest. Beneath the alluvial plain of the Big Black River in this area, the dip on the beds of the Vicksburg group is slight and the river flows along the strike of these beds, possibly along a joint system.

STRATIGRAPHY

GENERAL STATEMENT

Before undertaking a discussion of the strata exposed on the surface in Hinds County and the shallow subsurface stratigraphy, the writer feels the need to make an introductory statement. In any discussion of stratigraphy conflicts in nomenclature invariably arise. These conflicts sometimes come from a lack of understanding of the stratigraphic position of beds, but the portion of the geologic column applicable to Hinds County has been placed in correct order for some time. Conflicts also arise in attempting to extend nomenclature across several states. At times geologists working in the same area place different interpretations on essentially like data. It is a certainty that all nomenclature used by the writer in this report will not be accepted by all geologists.

The Mississippi Geological Survey has realized that nomenclatural differences frequently arise and has placed in this and several previous reports its statement on policy in stratigraphic nomenclature. The essence of this statement is that geologic knowledge is accrual and geologic conclusions and the nomenclature of geology are subject to review and revision. The writer of this report has consulted frequently with the Director and other Survey Staff Members and on the basis of these consultations and the information available to him at this time has formulated his stratigraphic nomenclature for Hinds County.

In the formulation of this nomenclature the writer has read all pertinent literature. A general review of the derivation of nomenclature applicable to this report is not given but on the discussion of specific strata previous work is mentioned where pertinent. An intensive study of the outcrops was made and 63 holes were drilled by the Survey in the course of this investigation. The samples and electrical logs of these holes along with samples and/or electrical logs on many water wells and core holes drilled by others were studied to gain a better understanding of the stratigraphic units. The writer professes no qualifications as a paleontologist and the stratigraphic nomenclature was arrived at without detailed paleontologic work. The units discussed in this report are essentially rock-stratigraphic units and should be regarded as such.

SHALLOW SUBSURFACE STRATIGRAPHY

Although these beds are not exposed at the surface in Hinds County, the strata from the top of the "Gas Rock" to the base of the Cockfield formation are discussed in general terms. This is to give a better understanding of the lithology and stratigraphic position of some of the units mentioned in "Hinds County Structural Geology" and "Hinds County Water Resources." The stratigraphic column from the "Gas Rock" to the Cockfield is shown in Figure 4.

TOP OF THE GAS ROCK AND CLAYTON LIMESTONE

The lower datum on the East-West cross section in "Hinds County Structural Geology" is called the top of the Jackson "Gas Rock" or Clayton limestone. This datum is so labeled because of the difficulty in determining the actual top of the "Gas Rock" of Cretaceous age from electrical logs and even from cuttings. Many times a point referred to as the top of the "Gas Rock" may be the top of the overlying Clayton limestone.

SYSTEM	SERIES	GROUP	Stratigraphic unit	Thickness (feet)	LITHOLOGIC CHARACTER
TERTIARY	EOCENE	CLAIBORNE	Cook Mountain formation	100-200	Gray-brown, micaceous clay; with beds of gray, glauconitic fossiliferous, sandy marl.
			Kosciusko formation	300-850	Gray, fine-to coarse-grained sand. Gray silty clay. Thin beds of lignite.
			Zilpha formation	250-400	Dark-gray to brown fossiliferous clay.
			Winona formation	10-30	Gray to green, glauconitic, calcareous sand and sandy marl.
			Tallahata formation	75-250	Light-gray to green clay; with some beds of gray siltstone and silty clay.
		WILCOX	Undifferentiated	1150-3000	Fine-to coarse-grained sands. Gray to brown micaceous, carbonaceous shales and silty shale.
	PALEOCENE	MIDWAY	Midway shale (Porters Creek formation)	75-1000	Dark-gray to black shale. Fossiliferous and pyritic in lower part.
			Clayton formation	3-30	Gray, fossiliferous limestone. Contains reworked Cretaceous material.

Figure 4.—Stratigraphic column of subsurface strata of Hinds County from the top of the "Gas Rock" to the base of the Cockfield formation.

The surface of the "Gas Rock" is irregular due in part to structural uplift but also to depositional irregularities. The "Gas Rock" is thought to be a reef-type limestone. A reef area with its atolls, lagoons, etc., would be expected to have an irregular configuration. There also was erosion prior to the deposition of the Clayton.

The lithology of the "Gas Rock" is somewhat variable. At its top it is usually a light-gray to white, quite pure limestone, chalky in appearance. It grades downward into a harder, more crystalline limestone. The "Gas Rock" is very fossiliferous. In some localities it contains extensive algal masses and it is locally oolitic and in some cases pyritic. The "Gas Rock" is frequently quite porous with vugs and cavities lined with calcite. The "Gas Rock" is from 300 to 1100 feet thick in the Hinds County subsurface.

The Clayton limestone of Paleocene age is a gray, hard, fossiliferous limestone. It contains some reworked Cretaceous material. The Clayton is porous in some localities and contains crystalline calcite. The Clayton is usually quite thin being only 2 or 3 feet thick in several wells. Thicknesses of up to 30 feet have been reported for the Clayton but the exact thickness is almost impossible to determine unless whole cores are available. The writer has not seen cores of the Clayton over 2 or 3 feet thick.

MIDWAY SHALE

The Clayton is overlain by dark-gray to black, fossiliferous shale. This material is probably all of the Porters Creek formation of the Midway group but may contain beds of the Naheola formation. This shale is about 75 feet thick over the Jackson Dome and may be as much as 1000 feet in southwestern Hinds County. The lower portion is much more fossiliferous and is very pyritiferous in some localities. The contact with the underlying Clayton is gradational somewhat with a few feet of black, pyritic shale interbedded with dark gray fossiliferous limestone.

WILCOX GROUP

The Midway shale is overlain by a thick sequence of beds referred to in this report as the Wilcox group. The Wilcox can be divided into several formations in the outcrop area and in some subsurface areas but is undifferentiated in the Hinds County subsurface. The Wilcox is made up of a sequence of sands, shales and silts with some lignite. The sands are gray, fine- to coarse-grained, micaceous with some glauconitic, calcareous sands. The shales and silts are gray to brown, micaceous and carbonaceous, lignitic in part.

In this report the top of the Wilcox is placed at the top of the first sand below the clays and shales of the Tallahatta formation. This sand may be partly or wholly equivalent to the Meridian sand of the Tallahatta. This sand cannot be differentiated from upper Wilcox sands in the Hinds County subsurface.

The Wilcox is about 1150 to 1300 feet thick over the Jackson Dome and has a maximum thickness of 3000 feet in southwestern Hinds County. The Wilcox thins over the six salt domes in the County. There were shows of oil in Wilcox sands in wells drilled on the Brownsville Dome and oil was produced from the Wilcox at the Oakley Dome field. Only 300 feet of Wilcox sediment are present above the cap rock overlying the salt mass at Oakley. This cap rock is made up mostly of limestone with some anhydrite. It is quite porous in part and oil stained in part. A core of the cap rock from a well on the Oakley Dome is shown in Figure 5.

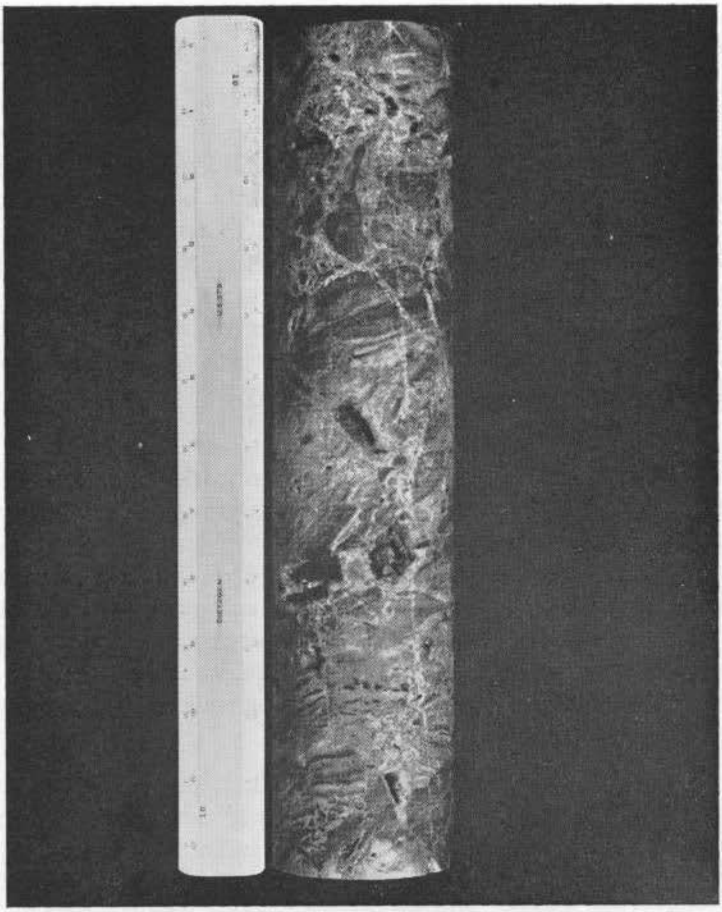

Figure 5.—Core of cap rock from Blanco Oil Co. & Fairchild Oil Co. No. 1 H. T. Shuff, Oakley Dome (SE.¼, SE.¼, Sec.27, T.5N., R.3W.) The rock is vuggy brecciated limestone deeply saturated with brown oil.

CLAIBORNE GROUP

Tallahatta Formation, Winona Formation and Zilpha Formation

Above the Wilcox and subjacent to the Kosciusko formation lies a sequence of beds considered as a unit by many geologists, particularly petroleum geologists, and called the Cane River formation. These beds are differentiated on the surface in Mississippi into three formations: the Tallahatta formation, the Winona and the Zilpha formations. These names are in use by the Mississippi Geological Survey and these beds are so designated in this report.

The Tallahatta formation is made up of light-gray to green shale and clay with some beds of gray siltstone and silty clay. The Tallahatta is about 75 feet thick over the Jackson Dome and thickens to 250 feet in southwestern Hinds County. The formation thins slightly over some of the salt domes in the County.

The Winona formation consists of gray to green, fine- to medium-grained, glauconitic, calcareous sand with some glauconitic sandy marl in several wells. The Winona is only 10 to 15 feet thick in some wells on the Jackson Dome. It thickens to 30 feet in wells located off the Jackson structure.

The Zilpha formation is made up of dark-gray to chocolate-brown, fossiliferous clay. The upper Zilpha is sandy and the lower Zilpha is glauconitic. The Zilpha is from 250 to 400 feet thick in the Hinds County subsurface. It generally thins over the Jackson Dome but not so much as other units. The electrical logs of some wells on the Jackson Dome show the Zilpha to retain almost its normal thickness, probably at the expense of the overlying Kosciusko formation.

Kosciusko Formation

Overlying the Zilpha formation is the Kosciusko formation known to many geologists as the Sparta. The Kosciusko is made up of gray, fine- to medium-grained sand with some coarse-grained sand and rare glauconite; gray, silty clay, lignitic in part; thin beds of lignite. The contact of the Kosciusko with the underlying Zilpha is difficult to determine unless a good basal sand is present as the upper Zilpha may be quite sandy.

The Kosciusko is about 300 feet thick on the crest of the Jackson Dome and thickens to 850 feet in southwestern Hinds County. The Kosciusko thins somewhat over the salt domes in Hinds County with the exception of the Learned Dome where a normal thickness is found. The greatest thinning is over the Oakley and Carmichael Domes.

The Kosciusko is an important aquifer in Hinds County and a more detailed discussion of the sands and their characteristics is found in "Hinds County Water Resources."

Cook Mountain Formation

Rocks of the Cook Mountain formation are the oldest to be encountered in drilling of the Survey's core holes in the course of the Hinds County investigation. The Cook Mountain is made up of an upper portion of gray-brown, micaceous, slightly carbonaceous clay and a lower portion of similar clay with several beds of gray, glauconitic, fossiliferous, sandy marl. In the lower portion of the formation the marl beds may be quite hard, being a sandy limestone in part and are referred to frequently as "rock" in drillers' logs.

The Cook Mountain is as thin as 100 to 130 feet in some wells on the Jackson Dome and thickens to about 200 feet in the southwestern part of the County.

The Cook Mountain was penetrated by three holes drilled by the Survey but the base of the formation was not reached in any of them. In Hole AF-17, 124 feet of Cook Mountain was penetrated. This interval consisted of 72 feet of gray-brown, micaceous clay and 52 feet of similar clay with three beds of gray, glauconitic, sandy, fossiliferous marl. The hole bottomed in gray-brown, micaceous clay. AF-17 is located near the crest of the Jackson Dome. Hole AF-18 encountered 160 feet of Cook Mountain beds to its total depth. The lithologies were similar to AF-17 with an upper clay section of 89 feet, followed by 8 feet of marl, 25 feet of clay, 4 feet of marl, 11 feet of clay, 3 feet of marl, and 20 feet of gray, shaly clay. AF-18 is on the southeastern flank of the Dome. AF-23 drilled on the western flank of the Dome encountered 64 feet of Cook Mountain clay.

SURFACE STRATIGRAPHY

The bedrock strata exposed in Hinds County are of the Eocene, Oligocene and Miocene series of the Tertiary system. A generalized section of these exposed strata is shown in Figure 6. The geographic extent of the various units is shown on Plate 1, the Geologic Map of Hinds County.

The geologic column in Hinds County includes sediments deposited in both marine and non-marine environments. Several transgressions and regressions of the sea are represented. The deposits include a variety of lithologies: sand, clay, silt, sandstone, siltstone, marl and limestone. The oldest strata crop out

SYSTEM	SERIES	GROUP	Stratigraphic unit	Thickness (feet)	LITHOLOGIC CHARACTER
QUATERNARY	RECENT		Alluvium	0-80	Fine-to coarse-grained sand; gravel, silt and clay. Contains organic material in some localities.
	PLEISTOCENE		Loess	0-30	Tan to brown silt. Contains land snail shells. In eastern part of county represented by weathered silts called the "brown loam."
			Pre-loess Terrace deposits	0-80	Chert and quartz gravel. Fine-to coarse grained sand. Occasional clay lenses. Sands weather to red color. Contains silicified wood in some localities.
			Citronelle formation	0-20	Chert and quartz gravel; with fine-to coarse-grained sand.
TERTIARY	MIOCENE		Catahoula formation	up to 500	Gray to white kaolinitic sands; locally indurated to form sandstone ledges. Tan to white siltstones. Gray, buff, green and purple, silty clays.
	OLIGOCENE	VICKSBURG	Bucatunna clay	15-60	Dark-gray to black, finely carbonaceous, pyritiferous, clay with thin silt and sand laminae. Weathers to chocolate brown.
			Byram marl	10-20	Gray-green, glauconitic, fossiliferous, clayey marl; slightly sandy in lower part. Contains some indurated ledges on the outcrop.
			Glendon limestone	25-50	Gray, fossiliferous, glauconitic, slightly sandy limestone. Alternating beds of gray-green, sandy, glauconitic, fossiliferous marl. Beds of limestone 1-3 feet thick.
			Mint Spring marl	5-30	Gray-green, fine-to coarse-grained, glauconitic, fossiliferous sand and sandy marl. Clayey in middle portion in some localities.
			Forest Hill formation	50-250	Very fine-to fine-grained, silty sand. Silty, carbonaceous clay. Thin beds of lignite. Has laminated appearance on outcrop.
	EOCENE	JACKSON	Yazoo formation	400-525	Blue-green, calcareous, fossiliferous clay. Weathers to greenish-yellow color. Upper few feet may be non-calcareous. Lower few feet very limy.
			Moodys Branch formation	10-45	Very limy, fossiliferous, glauconitic, clayey sand. Green to gray green in fresh exposures; weathers to a yellowish color.
		CLAIBORNE	Cockfield formation	225-550	Gray, silty, carbonaceous, micaceous clay. Gray, very fine-to fine-grained, silty sands. Thin beds of lignite.

Figure 6.—Generalized section of exposed strata in Hinds County.

at low elevations near the Pearl River in the City of Jackson. In the area around the Jackson Dome the sediments dip in all directions from the Dome. Away from this large structure, the dip is generally to the west-southwest. The youngest strata are exposed at the higher elevations in the southwestern part of the

County. The total composite thickness of the exposed section is about 1450 feet.

In some areas the bedrock is covered by surficial materials of terrace deposits, alluvium, colluvium and soils. A great portion of western Hinds County is covered by a blanket of loess which may be as much as 30 feet thick. These materials are of the Pleistocene and Recent series of the Quaternary system.

COCKFIELD FORMATION

Upper strata of the Cockfield are the oldest surface beds in Hinds County. The outcrop belt of Cockfield is confined to a small area within the City of Jackson. The Cockfield crops out in a few stream beds and along the bluffs of the Pearl River. It is also present beneath the Pearl River alluvial plain as shown on the Geologic Map.

The Cockfield consists of gray, silty, carbonaceous, micaceous clays; gray, very fine- to fine-grained, silty sands and thin beds of lignite. On the weathered outcrops the sands, silts and clays are gray, brown and buff.

The Cockfield is about 225 feet thick on the Jackson Dome and thickens to over 550 feet in the southwestern portion of the County. Only the upper 30 feet are exposed at Jackson. Several of the core holes drilled by the Survey in east-west and north-south lines across the Jackson Dome penetrated the entire Cockfield. These wells and their structural position on the Dome are shown on Plate 2. The Cockfield is 248 feet thick in Hole AF-17, 232 feet thick in AF-18 and 260 feet thick in AF-23.

The contact between the Cockfield and the underlying Cook Mountain formation is not exposed in Hinds County but is said to be a slightly irregular, erosional surface in Madison County by Priddy[31] and in Attala County by Parks.[32] The Cockfield is overlain disconformably by the Moodys Branch formation. The disconformity is characterized by fragments of Cockfield clays reworked into the basal Moodys Branch; by a sharp change from Cockfield silty clays to Moodys Branch limy sands; and by borings in the upper Cockfield filled with glauconitic, fossiliferous sand of the overlying Moodys Branch. The upper 12 feet of Cockfield were cored in Hole AF-17 located in Riverside Park, City of Jackson, 800 feet from the west line and 750 feet from the north line of Sec.36, T.6N., R.1E. This interval consisted of

7 feet of gray, carbonaceous clay, with borings filled with glauconitic, fossiliferous sand and 5 feet of gray, fine-grained, silty sand.

Outcrops of the Cockfield are limited due to the small areal extent of the surface exposure. A few of these outcrops are:

(1) in the west valley wall of Eubanks Creek (formerly called Crane Creek) in the SW.¼, SW.¼, Sec.25, T.6N., R.1E., where there are about 15 feet of silty sands and sandy silts. Monroe[33] reports 28 feet of Cockfield at this locality but the outcrop is now badly slumped.

(2) at "Fossil Gulch" along the nature trail in Riverside Park in the NW.¼, NW.¼, Sec.36, T.6N., R.1E., where about 5 feet of gray, carbonaceous clay with glauconitic sand-filled borings are overlain by the Moodys Branch formation.

(3) in the cut of the Gulf, Mobile and Ohio Railroad about 200 yards southwest of the Jackson waterworks in the NE.¼, SE.¼, Sec.35, T.6N., R.1E., where there are about 10 feet of sand, silty, carbonaceous clays and silty sands of the Cockfield overlain by the Moodys Branch. Outcrop is badly weathered.

(4) at the type locality of the Moodys Branch formation on Moodys Branch southeast of the corner of Poplar Boulevard and Peachtree Street in the City of Jackson, in the SW.¼, SW.¼, Sec.35, T.6N., R.1E., where 3 feet of gray, carbonaceous Cockfield clays underlie the Moodys Branch.

(5) on Moodys Branch east of the bridge at Greymont Street, Jackson, in SW.¼, SW.¼, SE.¼, Sec.35, T.6N., R.1E., where about 4 feet of crossbedded, clayey, silty sands are exposed.

(6) in ditch behind the tennis courts at River Hills Tennis Club in SW.¼, SW.¼, NW.¼, Sec.30, T.6N., R.1E., where about 4 feet of dark-gray, carbonaceous, silty clay is exposed below the Moodys Branch formation.

Descriptions of the complete subsurface Cockfield section present on the Jackson Dome can be found in the test hole records of AF-17, 18 and 23.

MOODYS BRANCH FORMATION

The Moodys Branch marl was named by Lowe[34] in 1915 from exposures along Moodys Branch in Jackson. The type locality is considered to be on Moodys Branch just southeast of the corner of Poplar Boulevard and Peachtree Street, in the SW.¼, SW.¼, Sec.35, T.6N., R.1E.

The Moodys Branch is considered by the writer to be a formation. According to the definition of rock-stratigraphic units in the Code of Stratigraphic Nomenclature of the American Commission on Stratigraphic Nomenclature, the Moodys Branch possesses the lithologic characteristics and extent of mappability required for a formation.

The Moodys Branch was considered by some geologists to be the lower member of the Jackson formation with the Yazoo clay and the Forest Hill sand as the other members. This division of strata was made with the concept that a formation is a fundamental genetic unit consisting of a transgression, an inundation and a regression.

For reasons to be explained in the discussion of that unit, the Forest Hill is placed in the Oligocene as a separate formation.

The Moodys Branch crops out in a narrow band near the Pearl River within the City of Jackson. Its outcrops are confined to lower elevations, stream beds and gullies. On the outcrop the Moodys Branch is a very limy, fossiliferous, clayey, glauconitic sand. It is green to gray-green in fresh exposures and weathers to a yellowish color. It contains partly indurated layers of soft, sandy, clayey limestone in some exposures. One of these more indurated ledges is shown in Figure 7.

The Moodys Branch was deposited by the transgressing Jackson sea and its contact with the underlying Cockfield is disconformable. As the inundative phase of the Jackson was reached the supply of sand became less and less and the Yazoo clay was deposited. The Moodys Branch grades upward into the Yazoo clay with no appreciable break. The upper contact has been placed at a point where the sand and glauconite content becomes negligible. This is a point recognizable on electrical logs used in subsurface correlations.

Within the limits defined above, the Moodys Branch is 10 to 15 feet thick in the outcrop area. It varies in thickness on

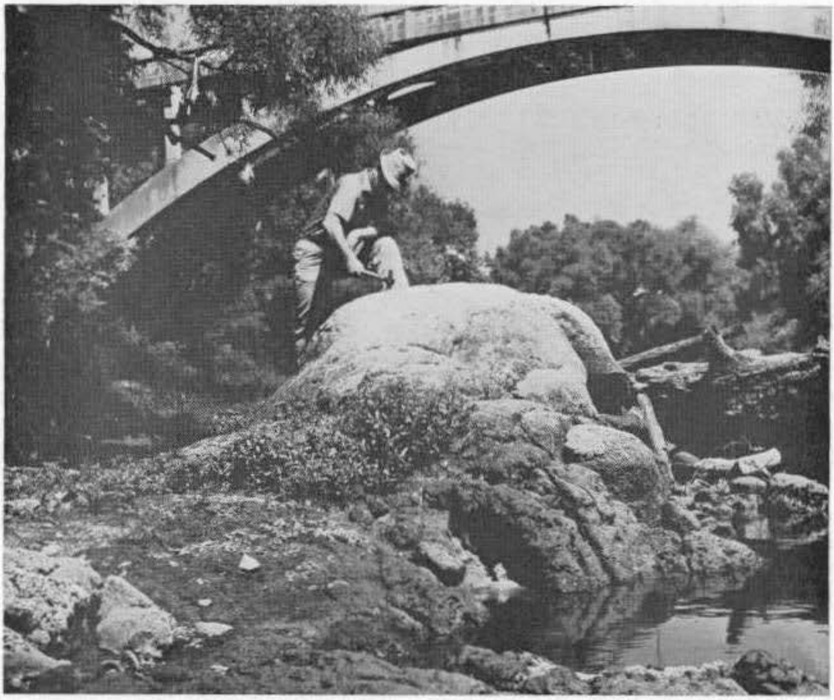

Figure 7.—Indurated Moodys Branch marl in west bank of Pearl River beneath Woodow Wilson bridge in NE.¼, SE.¼, Sec.10, T.5N., R.1E. Perry Nations photo. September 22, 1964.

and around the Jackson Dome. These variations are shown in Plate 2. The Moodys Branch is 13 feet thick in Hole AF-17 on the crest of the Dome. It thins on the south flank of the Dome to 6 feet in AF-18 and 6 feet in AF-19. To the west the thickness remains fairly consistent being 14 feet in AF-23 and 15 feet in AF-24. To the north in the rim syncline of the Dome and north of the syncline the Moodys Branch thickens appreciably. It is 12 feet thick in AF-20, 33 feet thick in AF-21 and 35 feet thick in AF-22.

In central Hinds County the Moodys Branch is from 10 to 25 feet thick. Within Hinds County it is developed to a maximum thickness of 45 feet.

The Moodys Branch formation is extremely rich in well-preserved fossils. Geologists have collected specimens from outcrops of the Moodys Branch in Jackson for over a hundred years, and several publications have dealt with the fauna from these outcrops. A well-known fossil collecting locality is Riverside

Figure 8.—Lower Yazoo and Moodys Branch exposed in Riverside Park, Jackson, in NW.¼, NW.¼, Sec.36, T.6N., R.1E. Perry Nations photo. March 11, 1965.

Park in Jackson, in NW.¼, NW.¼, Sec.36, T.6N., R.1E., shown in Figure 8. This outcrop has been designated as an alternate type locality* of the Moodys Branch. Hole AF-17 was cored and drilled on the bluff just south of this outcrop to sample the Moodys Branch and the overlying Yazoo clay for lithologic and paleontologic studies and to provide material for chemical analysis and testing. The electrical log of this hole is shown in Figure 9. The upper 69 feet of AF-17 were cored continuously and the descriptions of this interval provide a better measured section than could be obtained on the outcrop.

*The Riverside Park locality was designated an "Alternate Type Locality" of the Moodys Branch by E. H. Rainwater in "Unit I, Type Localities Project" (1960) sponsored by the Gulf Coast Section of the Society of Economic Paleontologists and Mineralogists.

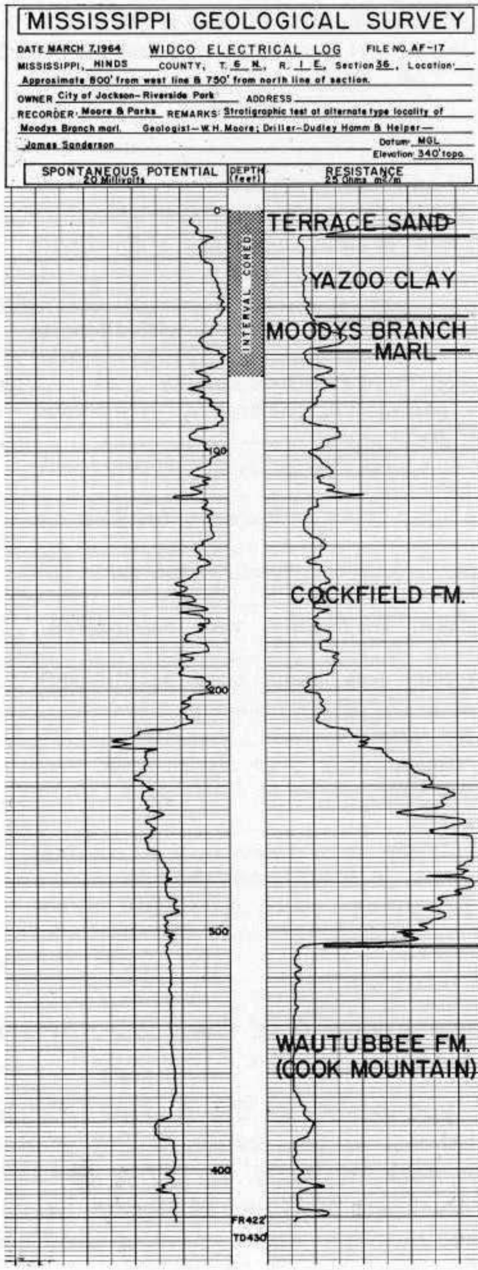

Figure 9.—Electrical log of hole drilled to sample the lower Yazoo clay and Moodys Branch formation in Riverside Park, Jackson.

Cored section from AF-17 in Riverside Park, City of Jackson. Approximately 800 feet from west line and 750 feet from north line of Sec.36, T.6N., R.1E.

	Feet	Feet
Recent		6.0
Soil, brown silt and sand	6.0	
Terrace deposit		3.0
Sand, yellow, fine- to medium-grained, stained with iron	3.0	
Yazoo formation		35.0
Clay, light-green to yellow, mottled, with limonite streaks and black streaks of manganiferous material	1.0	
Clay, light-green, manganiferous streaks	3.5	
Clay, tan to pale-green, calcareous, gypsiferous, very fossiliferous	5.0	
Clay, tan mottled with blue-gray, calcareous, fossiliferous	2.5	
Clay, gray to gray-green, calcareous, fossiliferous, some pyrite	13.0	
Clay, blue-gray, calcareous, fossiliferous, some pyrite	4.5	
Clay, light-green, very limy, very fossiliferous, glauconitic	2.5	
Clay, light-green, very limy, very fossiliferous, glauconitic, sandy	3.0	
Moodys Branch formation		13.0
Sand, green, fine-grained, very fossiliferous, very glauconitic, very limy, clayey in upper part	13.0	
Cockfield formation		12.0
Clay, gray, slightly carbonaceous; with borings filled with glauconitic, fossiliferous sand	7.0	
Sand, gray, fine-grained, silty, micaceous, carbonaceous	5.0	
Total cored section		69.0

Other prominent outcrops of the Moodys Branch where fossils may be collected are:

(1) at the type locality of the Moodys Branch on Moodys Branch just southeast of the corner of Poplar Boulevard and Peachtree Street, Jackson, in SW.¼, SW.¼, Sec.35, T.6N., R.1E., where the total thickness of 13 feet of Moodys Branch is exposed below limy Yazoo clay and above clays of the Cockfield.

(2) in the roadcut and ditch along a gravel road just north of the tennis courts at River Hills Tennis Club in SW.¼, SW.¼,

Figure 10.—Calcareous nodules on weathered Moodys Branch in roadcut on north side of River Hills Tennis Club in SW.¼, SW.¼, NW.¼, Sec.30, T.6N., R.1E. Perry Nations photo. March 26, 1965.

NW.¼, Sec.30, T.6N., R.1E., where about 12 feet of Moodys Branch limy sand are exposed below very limy Yazoo clay and above 4 feet of carbonaceous Cockfield clay. Calcareous nodules developed in the Moodys Branch are shown at this location in Figure 10.

(3) in three cuts of the Gulf, Mobile and Ohio Railroad between Moody Street and the Jackson waterworks in the SE.¼, Sec.35, T.6N., R.1E. and the NE.¼, Sec.2, T.5N., R.1E., where weathered Moodys Branch limy sand is exposed.

(4) in the bed and wall of Moodys Branch at the bridge on Greymont Street, Jackson, in SE.¼, SE.¼, SW.¼, Sec.35, T.6N., R.1E., where about 10 feet of Moodys Branch are exposed.

(5) in the bed of Town Creek from just east of the Gulf, Mobile and Ohio Railroad bridge and for a considerable distance upstream in Sec.10, T.5N., R.1E., where gray-green Moodys Branch sand is exposed.

Descriptions of the Moodys Branch interval can be found in the test hole records of AF-17, 18, 19, 20, 21, 22, 23 and 24.

YAZOO FORMATION

Lowe[35] in 1915 named the upper part of the Jackson group the Yazoo clay marl. The name was shortened by Cooke[36] in 1918 to the Yazoo clay member of the Jackson formation. The Yazoo is considered now by many geologists to be a formation. Murray[37] divided the Yazoo in Jasper and Clarke Counties into four members. These members cannot be recognized in Hinds County where the Yazoo is essentially an homogeneous unit.

The outcrop area of the Yazoo surrounds the small inlier of Moodys Branch and Cockfield on the crest of the Jackson Dome and covers the northeastern corner of the County. The outcrop belt of the Yazoo is much wider in other areas but steep dips on the Jackson Dome account for the narrower outcrop belt in Hinds County. The rolling terrain of the Jackson prairie belt is developed on the Yazoo clay. The low relief on the Jackson prairie is caused by the erosibility of the Yazoo clay and by its tendency to slip and flow when wet. This slippage and flow tends to flatten slopes.

The Yazoo clay is a fairly homogeneous unit consisting of blue-green to blue-gray, calcareous, fossiliferous clay with some pyrite. The upper few feet of the Yazoo is non-calcareous and slightly silty. The Yazoo is very limy and glauconitic just above the contact with the subjacent Moodys Branch formation. Beds of soft, white, argillaceous limestone are present in some localities. The limestone beds lie about 100 feet from the top of the Yazoo.

The Yazoo clay weathers to a yellowish or greenish yellow color. The weathered clay frequently is stained by limonite and manganese along joints. When badly weathered the Yazoo clay may be non-calcareous but weathered Yazoo frequently is quite calcareous. Calcareous nodules are quite commonly found in outcrops of weathered Yazoo. Gypsum crystals in the selenite form are common at the outcrop and are found at depths up to 30 or 40 feet in the Yazoo clay. These gypsum crystals probably are formed by effects of the decomposition of pyrite on fossils and lime in the clay. Pyrite is not found in the oxidized Yazoo clay and gypsum is not found in the unoxidized clay. The gypsum crystals frequently are stained with limonite. Figure 11 shows concentrations of selenite crystals in the Yazoo clay.

Figure 11.—Selenite crystals in joints of Yazoo clay, west wall of Jackson Ready-Mix Lightweight Aggregate clay pit in SW.¼,NE.¼, NW.¼, Sec.36, T.7N., R.1W. Photo by R. R. Priddy. September 4, 1959.

The full thickness of the Yazoo is exposed in a relatively short distance on the northwestern and southwestern flanks of the Dome. Plate 2 shows the stratigraphic and structural positions of the Yazoo on the Dome. Hole AF-17, located in Sec.36, T.6N., R.1E., penetrated 35 feet of Yazoo above the Moodys Branch. In AF-18, located in Sec.16, T.5N., R.1E., 82 feet of Yazoo were present. In AF-19, 4.4 miles southwest of AF-18, the entire thickness of the Yazoo was present beneath the Forest Hill formation. The Yazoo is 434 feet thick in this hole, located in Sec.6, T.4N., R.1E. This is slightly less than the average thickness of about 450 feet in the subsurface area around the Jackson Dome. This thickness generally is maintained along strike except around the Brownsville Salt Dome in T.7N., R.2W. One well drilled on the flank of the Dome encountered a Yazoo section 400 feet thick while in a well drilled on top of the Dome the Yazoo was 500 feet thick. This anomalous condition probably is due to faulting.

The Yazoo thickens down dip to maximum of about 525 feet in southwestern Hinds County. Wells on the Oakley Salt Dome contain abnormal thicknesses of Yazoo. As at Brownsville this probably is due to faulting. Other variations in thickness of the Yazoo are seen in some wells where the overlying Forest Hill seems to have thickened at the expense of the Yazoo.

The Yazoo clay overlies the Moodys Branch conformably. The contact is gradational and the lower limit of the Yazoo is placed at the point where the sand content of the sediments becomes appreciable. The gradational contact with the Moodys Branch is exposed in a gully in Riverside Park in Sec.36, T.6N., R.1E. Hole AF-17 was drilled and cored just south of this locality and the description of the cored interval is given in the discussion of the Moodys Branch formation. The contact also is exposed in the roadcut and ditch along a gravel road just north of the tennis courts at River Hills Tennis Club in SW.¼, SW.¼, NW.¼, Sec.30, T.6N., R.1E. The lower few feet of the Yazoo are extremely limy with samples from the lower 4 feet of Yazoo in AF-17 containing over 60 percent calcium carbonate.

Outcrops of the Yazoo clay are numerous but usually are badly weathered and slumped. Fresh outcrops were observed along the newly widened channel of Hanging Moss Creek in the northern portion of Sec.13 and Sec.14, T.6N., R.1E., and Sec.18, T.6N., R.2E. These outcrops are overlain by as much as 15 feet of alluvial sands and silts. Fresh Yazoo clay can be seen also at the mouth of Lynch Creek in the SW.¼, Sec.15, T.5N., R.1E.

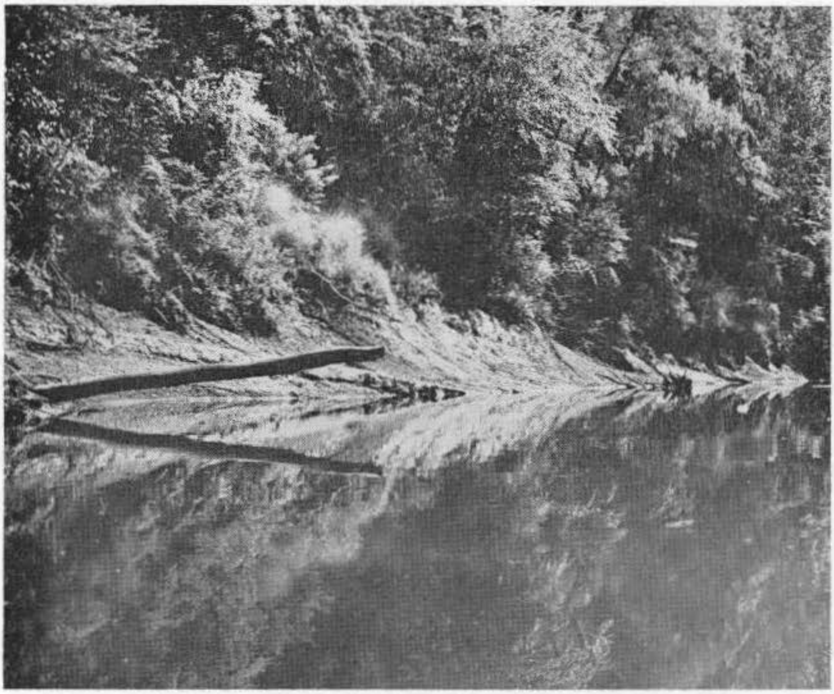

Figure 12.—Limestone bed in upper Yazoo clay in east bank of Pearl River in NE.¼, Sec.22, T.5N., R.1E., Rankin County. Perry Nations photo. September 22, 1964.

The best exposure of fresh Yazoo clay in Hinds County can be seen in the clay pit of the Jackson Ready-Mix Concrete Lightweight Aggregate Plant in the SW.¼, NE.¼, NW.¼, Sec.36, T.7N., R.1W., where over 60 feet of clay are exposed.

On a boat trip down the Pearl River* on September 22, 1964, other good outcrops of Yazoo were observed, particularly the upper Yazoo. In the east bank of the River in NE.¼, Sec.22, T.5N., R.1E., Rankin County, two beds of white, soft, argillaceous limestone each about one foot thick were seen. The more prominent limestone bed can be seen in Figure 12. These beds possibly correlate with resistivity "kicks" observed on electrical logs of water wells, core holes and oil tests. The "kicks" usually are in

*The purpose of this trip was to observe and photograph outcrops on both sides of Pearl River in conjunction with the mineral investigations being undertaken in Hinds and Rankin Counties.

the upper 100 to 150 feet of the Yazoo. An outcrop of the non-calcareous upper Yazoo is shown in Figure 13. This outcrop is only a short distance upstream from the first outcrops of the Forest Hill formation in Sec.10, T.4N., R.1E.

Figure 13.—Non-calcareous upper Yazoo clay in east bank of Pearl River in Sec.10, T.4N., R.1E., Rankin County. Perry Nations photo. September 22, 1964.

The non-calcareous portion of the Yazoo is interesting in its variation from the typical calcareous, fossiliferous Yazoo and its more laminated appearance. It is also from this section that thin bentonite beds have been reported. Bay[38] reported a bed of bentonitic clay one foot thick in a bore hole on old U. S. Highway 51, 3.7 miles south of its junction with State Highway 18. Outcrops of bentonite were not observed by the writer although a good outcrop of the upper few feet of the Yazoo is present on the southeast side of the Elton Road interchange on Interstate Highway 55 in NW.¼, NW.¼, Sec.5, T.4N., R.1E. A thin bentonite bed had been reported in SW.¼, SE.¼, NW.¼, Sec.5, T.7N., R.1W. Hole AF-40 was cored at this locality to sample this bed and the non-calcareous section of the upper Yazoo. The bentonite bed was not encountered in this hole but the description of the cored interval points out the lithology of the upper Yazoo.

Cored section from AF-40 located 25 feet north of east-west gravel road in SW.¼, SE.¼, NW.¼, Sec.5, T.7N., R.1W.

	Feet	Feet
Loess		7.0
Silt, tan to brown	7.0	
Terrace deposit		1.0
Sand, brown, coarse-grained	1.0	
Yazoo formation		42.0
Clay, tan to brown, slightly silty, non-calcareous, limonitic staining on fractures, gypsiferous in part	18.5	
Clay, blue-green, calcareous, rare fossils	15.5	
Clay, blue-green, calcareous, quite fossiliferous	8.0	
Total cored section		50.0

The apparent lack of calcareous material in the upper 18.5 feet of the Yazoo was substantiated by chemical analysis of a sample of this interval. This analysis showed only 0.12 percent CaO in this sample. Analysis of a sample from 18.5 to 42 feet showed 7.47 percent CaO.

Descriptions of all or parts of the Yazoo interval are found in the test hole records of Holes AF-1, 3, 5, 6, 7, 8, 17, 18, 19, 20, 21, 22, 23, 24, 25, 38, 39, 40, 50, 52 and 53.

The Yazoo clay generally is quite fossiliferous with a particularly good suite of microfossils. The microfossils are not as easily obtained as those from the underlying Moodys Branch. The best known fossil from the Yazoo clay is the whale-like mammal *Basilosaurus cetoides*. The remains of these animals have been found at several locations over the County. A number of different specimens have been uncovered in the clay pit of the Jackson Ready-Mix Concrete Lightweight Aggregate Plant. Some 15 vertebrae with numerous rib bones and a section of the jaw from one of the specimens is now housed at the Survey's offices at 2525 North West Street, Jackson. A large vertebrae and a portion of the jaw are shown in Figure 14.

The Yazoo clay also causes serious foundation problems in highway building and other construction. The Yazoo is very incompetent at the surface and it slips or slides and expands or contracts depending on varying moisture content. No completely satisfactory method has been found to stabilize this material. Most of the present-day City of Jackson is built on the outcrop belt of the Yazoo and many residents of the City and surrounding areas become aware of the Yazoo clay due to shifting and crack-

Figure 14.—Vertebrae and portion of jaw of whale-like mammal **Basilosaurus cetoides.** Found in Yazoo clay in clay pit of Jackson Ready-Mix Lightweight Aggregate Plant. Perry Nations photo. March 5, 1965.

ing of the foundations of their homes. Only homes and buildings built on the outcrop of the Moodys Branch marl and the Cockfield formation and the alluvial plain of the Pearl River and its tributaries are free of the foundation problems caused by the Yazoo in the Jackson area.

FOREST HILL FORMATION

The name Forest Hill sand was proposed by Cooke[39] in 1918 in place of the preoccupied name "Madison sands" suggested by Lowe[40] for beds between the Jackson marine beds and the marine marls of the overlying Vicksburg group. Mellen[41] considered the Forest Hill to be the upper regressive member of the Jackson formation. The writer places the Forest Hill in the Oligocene as a formation. Further investigation of the relationship of the Forest Hill to the Red Bluff formation and a better understanding of the quite variable thickness of the Forest Hill in Hinds County is needed to completely resolve the nomenclatural problem involving the Forest Hill.

The Forest Hill is exposed in a rather narrow band generally around the Hinds County portion of the Jackson Dome. It is present also beneath the flood plain of the Big Black River and exposed in some of the tributary streams of the Big Black in northwestern corner of the County. The Forest Hill forms a rather prominent cuesta on the southwestern flank of the Dome and a more subdued ridge on the western side. On the northwestern flank of the Dome the Forest Hill outcrop belt has been breached by Bogue Chitto and Lime Kiln Creeks. In this area the outcrops of Forest Hill are discontinuous as shown on the Geologic Map, Plate 1.

Figure 15.—Forest Hill silts and clays exposed in a roadcut of north-south asphalt road just south of its juncture with U. S. Highway in NW.¼, SW.¼, Sec.29, T.6N., R.1W. Perry Nations photo. March 5, 1965.

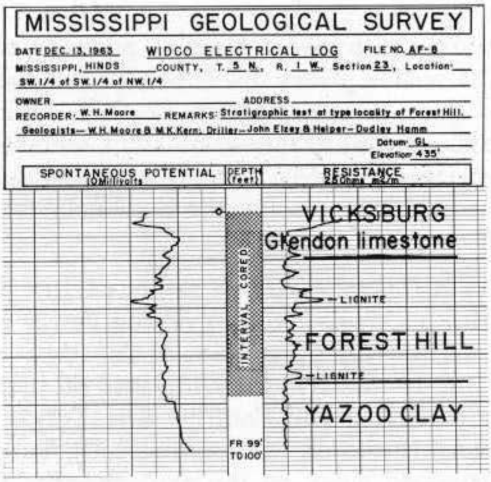

Figure 16.—Electrical log of hole drilled at the type locality of the Forest Hill formation. Location SE.¼, SE.¼, NE.¼, Sec.22, T.5N., R.1E., rather than in Sec.23 as noted on log heading.

The Forest Hill is made up of very fine- to fine-grained, silty, micaceous sands and silty, carbonaceous clay. There are several thin lignite beds in the Forest Hill. The Forest Hill is thinly bedded and presents a laminated appearance on the outcrop as shown in Figure 15. In the unweathered state the Forest Hill sands are gray to bluish-gray and the clays are gray to gray-brown. Where weathered the sands and clays may be gray, yellow, pink and buff. Thin limonite partings are common.

The type locality of this formation is on State Highway 18, ¼ mile northeast of Forest Hill School in the NE.¼, Sec.22, and the NW.¼, Sec.23, T.5N., R.1W. The type section was described along the road cut but this exposure is now badly weathered and slumped on the lower part. Hole AF-8 was cored and drilled to sample the Forest Hill at its type locality. A pilot hole was drilled to 100 feet and a hole was then cored to 77 feet. The electrical log of the pilot hole is shown in Figure 16 and the cores are shown in Figure 17. The description of the cored interval in AF-8 is used as a measured section of the type locality of the Forest Hill.

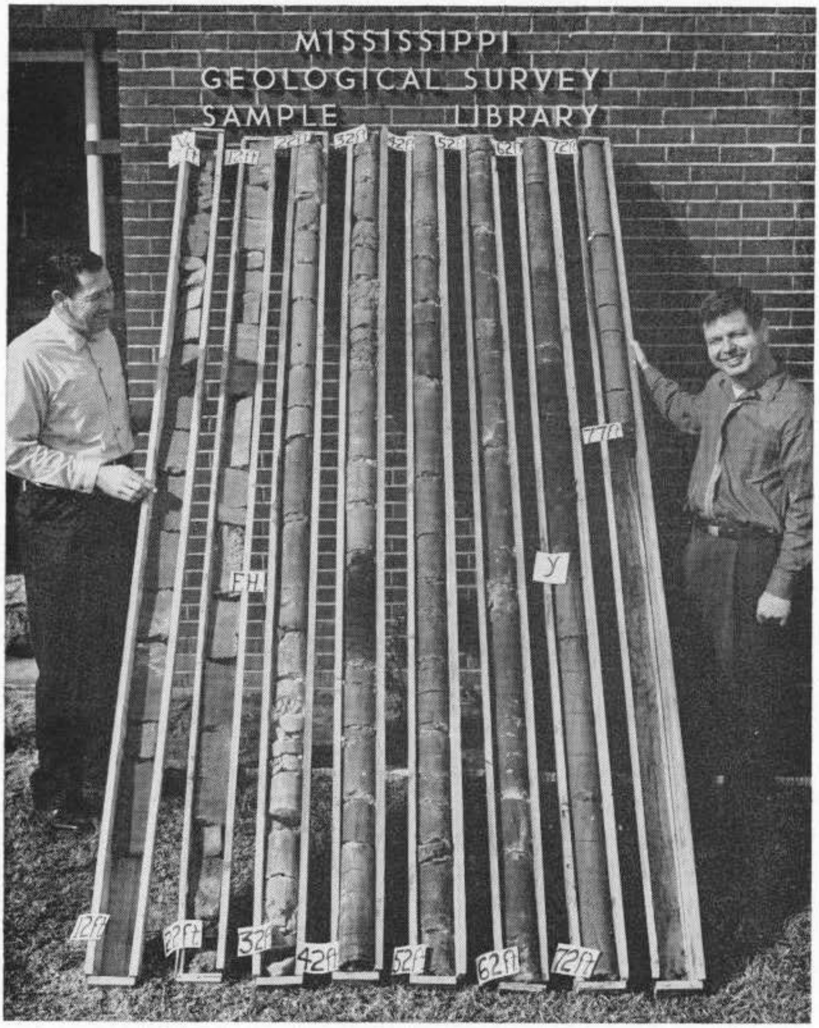

Figure 17.—Core taken at Forest Hill to sample the Forest Hill sand. Left to right and top to bottom: from Vx to F. H. is weathered Glendon limestone and marl; from F. H. to Y. is Forest Hill sand, silt, clay, and lignite; and from Y. to 77 ft. is uppermost Yazoo clay. Note two beds of lignite (dark-colored) in Forest Hill. Perry Nations photo, 1964.

Cored section from AF-8, located just northeast of the intersection of State Highway 18 and Forest Hill road, 20 feet from the center of State Highway 18 in SE.¼, SE.¼, NE.¼, Sec.22, T.5N., R.1E.

	Feet	Feet
Soil and loess		6.0
Silt, tan, sand in upper part	6.0	
Vicksburg group (Glendon limestone and Mint Spring marl)		12.0
Clay, yellow, sandy, limy in part, slightly glauconitic, some limestone, badly weathered	12.0	
Forest Hill formation		51.0
Clay, brown, slightly carbonaceous with sand-filled borings	4.0	
Sand, yellow and gray, fine-grained, micaceous, silty, stained with limonite in part	3.0	
Clay, gray, silty, micaceous, finely carbonaceous	4.0	
Sand, gray to yellow, fine-grained, silty and clayey in part	8.0	
Lignite, black to brown	0.5	
Clay, gray, carbonaceous, micaceous, silty, very silty and sandy in part	28.5	
Sand, gray, fine-grained, very lignitic, with a few thin beds of lignite; clayey in lower 1 foot	3.0	
Yazoo formation		8.0
Clay, gray-green, slightly silty	8.0	
Total cored section		77.0

The Forest Hill is only 51 feet thick at the type locality but may be as much as 250 feet thick in other localities. The full thickness of the Forest Hill at the western and southwestern edge of its outcrop belt is 75 to 100 feet. The Forest Hill thickens slightly down dip but the greatest thicknesses are found in localities where a thick sand section develops at the base of the formation. The thickening of the Forest Hill at these localities seems to be at the expense of the underlying Yazoo. None of these thick sand sections were observed at the surface so that their relationship to the Yazoo could be studied. The electrical logs of several wells encountering a thick sand section are shown along with the isopachous map of the net sand thickness of the Forest Hill on Plate 3 of the section "Hinds County Water Resources."

The contact of the Forest Hill with the subjacent Yazoo is not sharp and can be placed usually only within a few feet.

The cores of the type locality show a 3-foot zone of lignitic, clayey sand overlying gray-green clays of the Yazoo. This interval may represent a soil zone. In these cores the Forest Hill overlies the non-calcareous upper Yazoo. In roadcuts in the center of the east half of Sec.9, T.5N., R.1W., calcareous Yazoo clay is overlain by silty, sandy Forest Hill clay although the actual contact is not seen. On the west side of old U. S. Highway 51 in SW.¼, SW.¼, NE.¼, Sec.31, T.5N., R.1E., calcareous clay of the Yazoo is overlain by sandy clay that merges upward into thinly laminated, very fine-grained sand. On the south side of a gravel road in NW.¼, SW.¼, Sec.5, T.7N., R.1W., non-calcareous Yazoo clay is overlain by silty clays and sands of the Forest Hill. These outcrops indicate erosion of the non-calcareous upper Yazoo in some localities before deposition of the Forest Hill sands and clays although no reworked Yazoo is found in the lower Forest Hill sediments.

The upper contact of the Forest Hill with the overlying Mint Spring marl is well exposed at only one locality. In a creek bed in the NW.¼, NW.¼, Sec.34, T.7N., R.4W., silty, sandy clays of the Forest Hill are overlain by limy sands of the Mint Spring. The contact appears to be disconformable as evidenced by borings in the upper few feet of the Forest Hill filled with glauconitic sand from above. In roadcut along a north-south gravel road approximately 1000 feet south of the center of Sec.28, T.8N., R.3W., clayey, silty Forest Hill sand is exposed. A few feet south the Mint Spring, glauconitic, limy sand is exposed. The actual contact is not seen at this locality.

Exposures of the Forest Hill are usually of small areal extent with some of the more prominent exposures other than the ones previously mentioned as follows:

(1) in east roadcut of north-south asphalt road just south of its juncture with U. S. Highway 80 in NW.¼, SW.¼, Sec.29, T.6N., R.1W., where laminated, silty, clayey sands of the Forest Hill are exposed.

(2) in the roadcut on the southeast side of the asphalt road from Clinton to Raymond in the SE.¼, SW.¼, Sec.30, T.6N., R.1W., where about 5 feet of yellow, pink and brown, silty, sandy Forest Hill clay with a 2-inch bed of lignite exposed below a thin bed of terrace gravel.

(3) in a pasture on the west side of a north-south gravel road, north of Pocahontas in NW.¼, SE.¼, Sec.3, T.7N., R.1W., where silty, sandy clay of the Forest Hill is overlain by loess.

(4) in the banks of the Pearl River in Sec.9, Secs. 10 and 15 of T.4N., R.1E., where as much as 8 feet of silty, fine-grained Forest Hill sand are exposed in several outcrops.

Lithologic descriptions of all or parts of the Forest Hill formations are found in the test hole records of Holes AF-1, 2, 3, 5, 6, 7, 8, 9, 12, 13, 19, 50, 51, 52, 53, 54 and 62.

Fossil leaves have been reported from the Forest Hill in Warren County. Monroe[42] in his report on the geology of the Jackson area reported fossil leaves in several exposures but did not give their locations. Samples of lignite from the core hole at the type locality of the Forest Hill have been sent to Donald W. Englehardt of Pan American Petroleum Corporation, Tulsa, Oklahoma, for palynologic study.

Figure 18.—Silicified wood at contact of Forest Hill formation and overlying terrace deposit exposed on west side of north-south road in SE.¼, SE.¼, SW.¼, Sec.25, T.5N., R.1W. Perry Nations photo. March 11, 1965.

Silicified wood in the Forest Hill has been reported many times. The writer found no exposures where silicified wood was present, in place, in the Forest Hill. At several localities specimens of silicified wood were found at the contact between the Forest Hill and an overlying terrace deposit. Figure 18 shows two pieces of silicified wood in a thin bed of sand and gravel beneath the "brown loam" and just above Forest Hill sandy, silty clay. This locality is on the west side of a north-south asphalt road in the SE.¼, SE.¼, SW.¼, Sec.25, T.5N., R.1W.

VICKSBURG GROUP

General Statement

In this report the Vicksburg group is used as a rock-stratigraphic unit which includes in ascending order the Mint Spring marl, the Glendon limestone, the Byram marl, and the Bucatunna clay. The Vicksburg group is shown as one unit on the Geologic Map of the County.

The Code of Stratigraphic Nomenclature of the American Commission on Stratigraphic Nomenclature defines a group as associated formations having significant lithologic features in common; or in some work, the term "group" has been applied to stratigraphic units that appear to be divisible into formations but have not yet been so divided.

The Mint Spring, Glendon, Byram and Bucatunna are associated marine units of limestone, marl and clay. They appear to be divisible into recognizable formations in Hinds County but are not formally proposed as such in this report. The Forest Hill is placed in the Vicksburg by some geologists. It is not included in the Vicksburg group by the present writer as it is a non-marine unit.

The Vicksburg group crops out around the flanks of the Jackson Dome in Hinds County. It is found on the back slope of the prominent cuesta formed by the Forest Hill formation. Its outcrop belt extends generally along strike to the northwestern portion of the County, being overlain by sizeable outliers of the Catahoula formation in some areas (see Geologic Map). It is covered by alluvium and loess in part and is generally exposed only in creek beds, gullies and roadcuts.

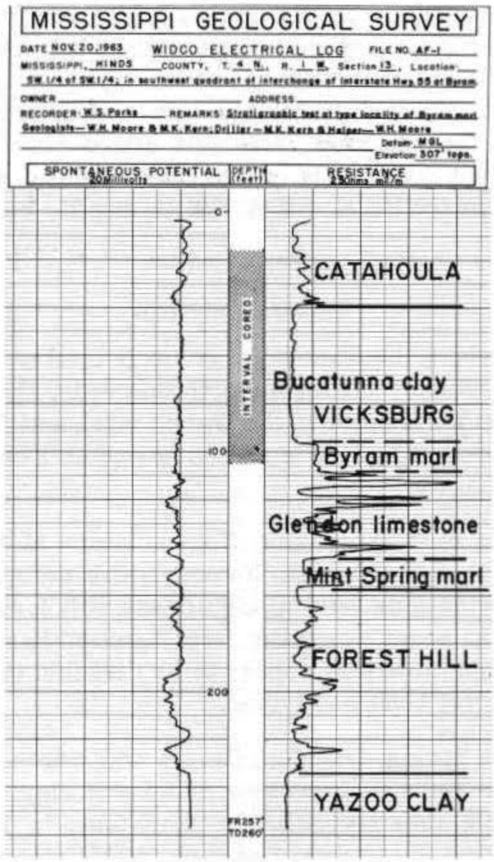

Figure 19.—Electrical log of the hole drilled to determine the stratigraphic position and thickness of the units of the Vicksburg group.

There is no single locality in Hinds County at which the entire Vicksburg group is exposed. Twin Holes AF-1 and AF-1A penetrated the entire Vicksburg group. The Vicksburg section described from cores and cuttings taken in these holes may serve as a type section of the Vicksburg group in Hinds County. The electrical log of AF-1 is shown in Figure 19.

Section from AF-1 and AF-1A drilled in the southwest quadrant of the Byram interchange on right-of-way of Interstate Highway 55 in SW.¼, SW.¼, Sec.13, T.4N., R.1W. Descriptions from cores of AF-1A, 0-108 feet; from cuttings in AF-1, 108-164 feet.

	Feet	Feet
Catahoula formation		38.0
Clay, tan, very silty, sandy	16.0	
Clay, gray to purple, hard, silty, very sandy in part, limonitic staining in part	18.0	
Sandstone, gray, fine-grained, silty, clayey in part	4.0	
Vicksburg group (Bucatunna clay)		58.0
Clay, gray, slightly silty, finely carbonaceous, with thin silt laminae	2.0	
Clay, dark-gray, plastic, very finely micaceous; with thin laminae of sand, gray, very fine- to fine-grained, glauconitic	12.0	
Clay, dark-gray, very finely micaceous, with thin silt laminae in part	38.0	
Clay, dark-gray, very finely micaceous, rare fossils	6.0	
Vicksburg group (Byram marl)		12.0
Marl, gray-green, very clayey, very glauconitic, fossiliferous, slightly sandy in lower part	12.0	
Vicksburg group (Glendon limestone)		33.0
Limestone, gray, fossiliferous, glauconitic	2.0	
Marl, gray-green, very clayey, glauconitic, fossiliferous	2.0	
Limestone, gray, glauconitic, fossiliferous, slightly pyritic	2.0	
Marl, gray-green, fossiliferous, very clayey, slightly glauconitic, limy clay in part	4.0	
Limestone, gray, fossiliferous, glauconitic	2.0	
Marl, gray-green, fossiliferous, glauconitic, clayey, slightly sandy	2.0	
Limestone, white, very glauconitic, fossiliferous, pyritic, soft	1.0	
Marl, gray, very glauconitic, very fossiliferous, slightly sandy; with thin beds of limestone, white, fossiliferous, glauconitic, soft	16.0	
Limestone, gray, glauconitic, fossiliferous, pyritic	2.0	
Vicksburg group (Mint Spring marl)		15.0
Sand, fine- to medium-grained, very limy, very fossiliferous, glauconitic	3.0	
Marl, gray-green, very clayey, fossiliferous, glauconitic	6.0	
Marl, gray-green, very sandy, fossiliferous, glauconitic	6.0	
Forest Hill formation		8.0
Clay, brown, carbonaceous, silty	8.0	
Total described section		164.0

The Vicksburg group is 118 feet thick in AF-1 and AF-1A. The Vicksburg is not present over the crest of the Jackson Dome and its thickness is not greatly affected by the structure. Where all four of the units in the group are present an average thickness for the Vicksburg is 100 to 125 feet.

Mint Spring Marl

The name "Mint Spring marl" was suggested by Cooke[43] in 1918 for sands and shell marls exposed in Mint Spring Bayou in Sec.12, T.16N., R.3E., Warren County, Mississippi.

The Mint Spring consists of gray-green, fine- to coarse-grained, glauconitic, fossiliferous sand and gray-green, glauconitic, fossiliferous sandy marl. It may be clayey in part. The Mint Spring contains much pyrite and black phosphatic fossil material. It is essentially a sand at many localities and some small output domestic water wells are completed in the Mint Spring. In other localities the upper few feet of the Mint Spring are a limy sand, the middle portion is a clayey, sandy marl and the lower portion a limy sand.

The lower limit of the Mint Spring is placed at the first occurrence of carbonaceous clays or fine-grained, carbonaceous, micaceous sands of the Forest Hill. The upper limit is the lowest indurated limestone bed of the Glendon.

The average thickness of the Mint Spring in Hinds County is 15 to 20 feet; however, the thickness varies over the County, from about 5 to over 30 feet. The Mint Spring overlies the Forest Hill disconformably and deposition on the eroded Forest Hill may cause variations in the Mint Spring thickness. The overlying Glendon also thickens at the expense of the Mint Spring in some localities.

The entire thickness of the Mint Spring is exposed at only one locality in Hinds County. In a creek bed in the NW.¼, NW.¼, Sec.34, T.7N., R.4W., about 12 feet of limy, glauconitic, fossiliferous Mint Spring sand overlies silty, sandy Forest Hill clay. The upper few feet of Forest Hill contains sand-filled borings. The Mint Spring is overlain by gray, hard, Glendon limestone at this locality.

Other outcrops of the rarely exposed Mint Spring are:

(1) in the roadcut on the east side of a north-south gravel road 1000 feet south of the center of Sec.28, T.8N., R.3W., where about 2 feet of limy sand are exposed.

(2) in the roadcut on the south side of U. S. Highway 80, one-half mile west of Clinton in NW.¼, NW.¼, Sec.30, T.6N., R.1W., where 4 feet of badly weathered, brownish-yellow, sparsely glauconitic sand are exposed.

(3) in the road ditch on the northwest side of the juncture of Terry Road and Lakeshore Road, 700 feet south of the center of Sec.31, T.5N., R.1E., where reddish-yellow, sparsely glauconitic sands are exposed.

Information on the lithology and thickness of the Mint Spring is found in the test hole records of Holes AF-1, 2, 3, 5, 6, 7, 8, 9, 12, 13, 51, 52, 53, 56 and 62.

Figure 20.—Glendon limestone and marl exposed on the west side of the road just north of Brookwood Country Club in NE.¼, Sec.2, T.4N., R.1W. Perry Nations photo. March 11, 1965.

The Mint Spring is quite fossiliferous in the subsurface, but the surface outcrops in Hinds County generally are too badly weathered to contain fossils.

GLENDON LIMESTONE

The Glendon limestone consists of alternating beds of gray, fossiliferous, glauconitic, slightly sandy limestone and gray-green, glauconitic, fossiliferous, sandy marl. The Glendon weathers to a yellowish or buff color. The limestone beds in the Glendon are not constant with the number, thickness and stratigraphic position varying from place to place. A hard bed about 10 feet from the top of the Glendon is the most consistent and usually the thickest. On the outcrop the marls weather more rapidly and the limestone ledges tend to stand out (Figure 20). The Glendon weathers completely in places leaving a dark-brown residual clay. Figure 21 shows a ledge of limestone, badly weathered and containing solution channels and cavities, overlain by the dark-brown residual clay. At some localities the residual clay contains white, partly weathered limestone and contains at other localities a white, waxy, clayey material. A sample of this material from the highly weathered Glendon in the center SE.¼, SW.¼, Sec.31, T.5N., R.1W., was sent to Z. S. Altschuler of the Petrological Services and Research Branch of Experimental Geochemistry and Mineralogy of the United States Geological Survey for study. His findings indicate that the material is a clay giving an x-ray pattern of major montmorillonite and halloysite in which kaolinite is still a trace constituent.

Thick beds of bentonite are present between ledges of Glendon limestone in Smith County. In Warren and Yazoo Counties thin beds of bentonite are present in the same stratigraphic position. No bentonite was observed in the Glendon on the outcrop in Hinds County and none was found in cuttings and cores collected by the Survey in this investigation.

The thickness of the Glendon, where the complete section is present, varies from 25 to 50 feet and averages about 35 feet. Outcrops of Glendon usually consist of a few discontinuous lime boulders or one limestone ledge. The thickest section of Glendon exposed at one locality is seen in the south wall of Rocky Creek in the NW.¼, SW.¼, Sec.3, T.6N., R.4W. There several ledges of limestone and intervening marl beds totaling about 20 feet are exposed. This locality is seen in Figure 37 in the section on economic geology.

The lower limit of the Glendon is placed at the lowest indurated limestone bed. The Glendon overlies the Mint Spring with no apparent break. The contact with the Mint Spring resembles the contact of other limestone and marl beds within

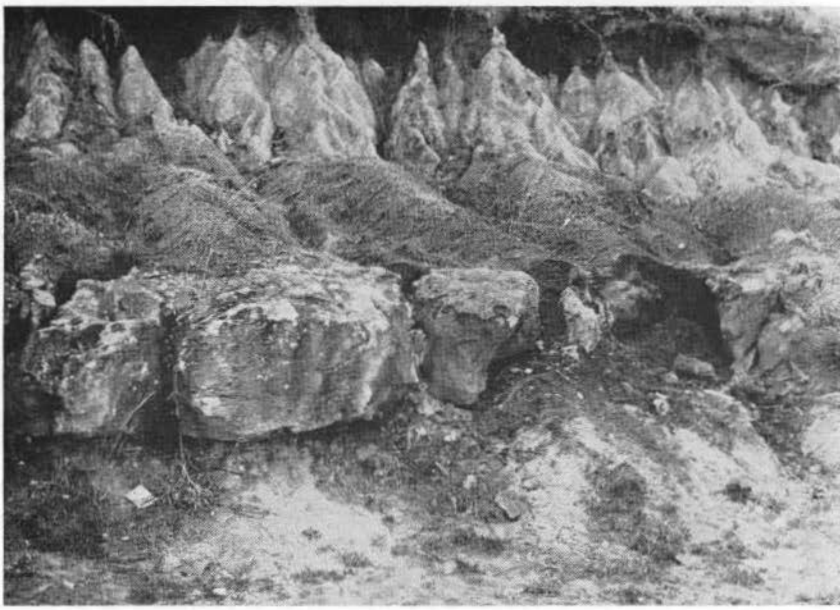

Figure 21.—Dark-brown residual clay above a ledge of Glendon limestone in roadcut on north side of U. S. Highway in NE.¼, Sec.25, T.6N., R.2W. Perry Nations photo. March 5, 1965.

the Glendon. This contact is not well exposed within the County but was cored in several holes in the County. Monroe[44] states that there is a marked faunal change in passing from the Mint Spring to the Glendon.

Good exposures of Glendon were observed on the boat trip down the Pearl River. Figure 22 shows beds of Glendon limestone dipping slightly west-southwest in the west bank of the Pearl River in NE.¼, Sec.19, T.4N., R.1E.

Prominent Glendon outcrops other than ones previously figured or mentioned are:

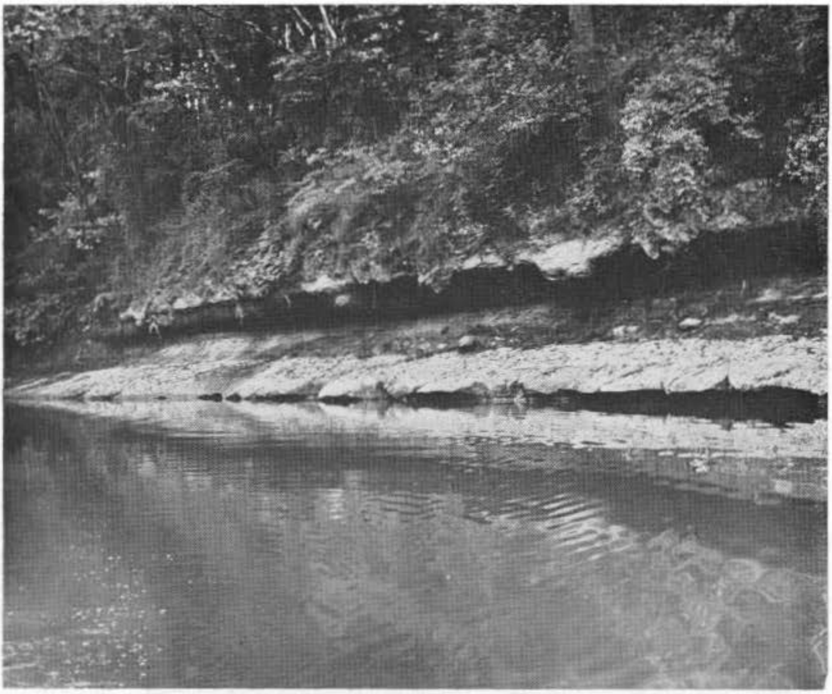

Figure 22.—Beds of Glendon limestone dipping slightly west-southwest in west bank of Pearl River in NE.¼, Sec.19, T.4N., R.1E. Perry Nations photo. September 22, 1964.

(1) on the west side of the Illinois Central Railroad about 2 miles north of Byram in the SW.¼, Sec.8 and SE.¼, Sec.7, T.4N., R.1E., where some 8 to 10 feet of limestones and marls are exposed. It has been reported that limestone was quarried at this locality before the turn of the century.

(2) in a sand pit in the NW.¼, SE.¼, Sec.6, T.4N., R.1E., where badly weathered Glendon is exposed beneath terrace sands and clays. This location is quite fossiliferous with abundant specimens of *Pecten sp.* and *Lepidocyclina sp.*

(3) in the roadcut on the east side of State Highway 18 just northeast of Forest Hill School in SE.¼, NE.¼, Sec.22, T.5N., R.1W., the weathered lower limestone ledge of the Glendon is exposed. Many good specimens of sharks' teeth have been collected at this locality.

(4) in an abandoned quarry just northwest of the center of Sec.1, T.5N., R.2W., ledges of limestone with alternating marl beds are exposed. Limestone and marl were quarried here for a short time for use as agricultural lime.

(5) in a railroad cut of the Yazoo and Mississippi Valley Railroad in the NW.¼, Sec.24, T.6N., R.2W., where a 3-foot ledge of limestone with about a foot of underlying marl is exposed.

(6) on the northeastern slope of Sand Hill in the NW.¼, Sec.31, T.7N., R.1W., a ledge of limestone about 2 feet thick is exposed for a short lateral distance at an elevation of 310 feet. This outcrop is a small outlier of Glendon found more than one and one-half miles east of the main outcrop belt of the Vicksburg group.

(7) in the bed of a creek in Sec.10, T.6N., R.4W., beds of Glendon limestone and marl are exposed for a distance of about one-half mile upstream from beneath a bridge on a north-south gravel road.

Additional information on the lithology and thickness of the Glendon can be found in the test hole records of Holes AF-1, 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 51, 52, 53, 54, 56, 62 and 63.

Byram Marl

The Byram marl is named for exposures in the banks of the Pearl River at Byram, Hinds County, Mississippi. The name "Byram" was first used by Casey[45] in 1901 although he incorrectly placed the marl exposed at Byram below the limestone exposed at Vicksburg. Monroe[46] includes this unit in his Byram formation which is made up of the Glendon limestone member, the middle marl member, and the Bucatunna clay member. Monroe's middle marl member includes some beds considered to be Glendon by the present writer.

As used in this report, the lower limit of the Byram marl is placed at the top of the highest hard limestone ledge of the Glendon. The upper limit is the lowest bed of dark-gray Bucatunna clay.

In placing the lower limit of the Byram, information gained in coring several holes was useful in determining the uppermost hard limestone ledge of the Glendon. The Byram marl may be somewhat indurated on the surface but it is easily cored with the Survey's plunger-extruding-type core barrel designed for coring soft materials. The limestone of the Glendon cannot be penetrated with this core barrel. The limestone beds of the Glendon can be recognized also by their electrical character. In electrical logs of the Survey's holes, water well logs and core hole logs, the top of the Glendon is picked on pronounced resistivity "kick."

The Byram marl consists of gray-green, glauconitic, fossiliferous, clayey marl and gray-green, glauconitic, fossiliferous, limy

Figure 23.—Exposure of Byram marl in the west bank of the Pearl River at the type locality of the Byram near Byram in NW.¼, NW.¼, Sec.19, T.4N., R.1E. Perry Nations photo. September 22, 1965.

clay. The lower part of the Byram is slightly sandy. The Byram is usually described as a sandy marl but cores taken at the type locality and at several other localities and cuttings from the Byram interval in other wells contain little sand. L. W. Simpson[47] in preparing samples of Byram marl from the type locality and a locality north of Edwards for paleontologic study found these samples to contain only 7 percent sand-size material. Much of this sand-size material is quartz sand but some of it is glauconite.

Hole AF-2 was cored and drilled on the river bank at the type locality of the Byram in NW.¼, NW.¼, Sec.19, T.4N., R.1E. This locality is shown in Figure 23. The electrical log of AF-2 is shown in Figure 24. The Bucatunna clay which normally

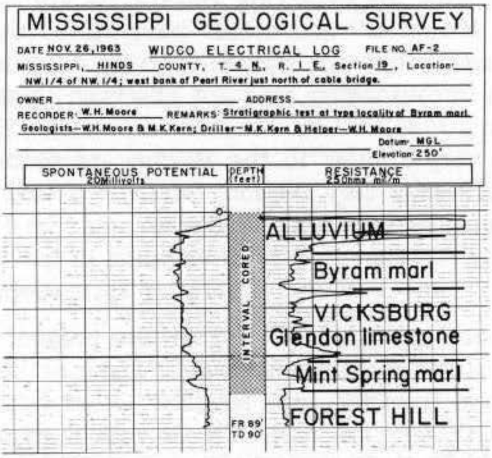

Figure 24.—Electrical log of hole drilled at type locality of the Byram marl.

overlies the Byram has been eroded at the type locality and the Byram is directly overlain by 17 feet of Pearl River alluvium. The contact of the alluvium and the Byram marl is at the vegetation line in Figure 23. The Byram is 13 feet thick at the type locality which is about the same Byram thickness as encountered in AF-1 about one mile away. Examination of the cores from AF-2 show the Byram to be made up of 13 feet of fairly homogeneous gray-green, clayey, glauconitic, fossiliferous marl, slightly sandy in the lower part. No hard ledges were encountered in coring this section. Hunt[18] measured the section exposed in the river bank and found it to be 9.5 feet thick to low water level in the river and containing several prominent ledges as seen in Figure 23. The ledges seem to be a surface phenomenon. This marl on the outcrop is stained a reddish-brown in part and seems to be siderite. Chemical analysis of several samples of Byram marl found it to contain over 6 percent Fe_2O_3.

The thickness of the Byram varies over the County from 10 feet to over 20 feet. The average thickness is about 15 feet.

In the western part of the County along the outcrop belt of the Vicksburg group the Bucatunna clay has been eroded and the Byram marl is overlain by stream alluvium. It is possible that part of the Byram also may have been eroded here.

Cores from AF-2 and AF-63 show the contact of the Byram with the underlying Glendon to be conformable. The contact of the Byram with the overlying Bucatunna also appears to be conformable. Blanpied[49] and others have stated that the Bucatunna is separated from the Byram marl by an erosional unconformity. This unconformity was not observed in samples or on the surface in Hinds County. Indeed in western Hinds County beds of marl very similar to the Byram are found within the Bucatunna dark-gray clay section. Mellen[50] found no evidence of an unconformity between the Byram and the Bucatunna in Warren County and includes the Bucatunna in the upper portion of his Byram member of the Vicksburg formation.

Good exposures of the Byram marl are present in the banks of the Pearl River for a considerable distance both upstream and downstream from the type locality. Other exposures of the Byram in the County are rare. The Byram is exposed beneath a bridge on old U. S. 51 near the center of SE.¼, SE.¼, Sec.12, T.4N., R.1W. The Byram is quite fossiliferous at this exposure. Another good exposure of Byram is found in the south bank of the Big Black River (at low water) at the base of the bluff just north of Mt. Beulah College in the NE.¼, Sec.29, T.6N., R.4W. Some 12 feet of fossiliferous Byram marl with several prominent ledges are seen at this locality.

Lithologic descriptions and thicknesses of the Byram are given in the test hole records of Holes AF-1 and 1A, 2, 3, 5, 6, 7, 9, 11, 12, 13, 52, 53, 56, 62 and 63.

Fossils of the Byram have been the subject of general reports. Good fossil collections can be made at the previously mentioned outcrops of Byram. Three reports concerning the fauna of the Byram are being completed now. These reports are:

(1) Lloyd W. Simpson, *Foraminifera of the Vicksburg*, M.S. thesis, Mississippi State University;

(2) Martin Mumma, *Ostracoda of the Vicksburg*, PhD. dissertation, Louisiana State University;

(3) Ronald Greely, *Tertiary lunulitiform bryozoa,* PhD. dissertation, Missouri School of Mines.

Bucatunna Clay

The Bucatunna clay was named by Blanpied[51] and others in 1934 for exposures along Bucatunna Creek in Wayne County, Mississippi. Blanpied considered the Bucatunna to be Miocene in age and a member of the Catahoula group. Monroe[52] considered the Bucatunna to be the upper member of his Byram formation. The Bucatunna now is generally considered to be Oligocene in age and is designated in this report as the uppermost unit of the Vicksburg group.

The Bucatunna consists of dark-gray to black, finely carbonaceous, sparsely pyritiferous clay with thin silt laminae. The clay contains thin beds of very fine- to fine-grained glauconitic sand in some localities and in the western part of the County beds of gray-green, clayey marl are present in the Bucatunna section. The Bucatunna weathers to a chocolate-brown color

Figure 25.—Weathered Bucatunna clay exposed in hillside west of Interstate Highway 55, 0.4 mile north of Byram interchange in NW.¼, Sec.13, T.4N., R.1E. Perry Nations photo. March 11, 1965.

with limonite staining on fractures. Thin limonite flakes are seen on the Bucatunna outcrop and a few gypsum crystals may be found. Figure 25 shows weathered Bucatunna with limonite flakes scattered over the face of the outcrop.

The Bucatunna thickness is quite variable over the County. Its maximum thickness is about 60 feet and the minimum about 15 feet. No average thickness would be applicable due to the wide variations. The marl beds found in the Bucatunna section in central and west central Hinds County are as much as 10 feet thick.

The contact of the Bucatunna with the underlying Byram marl is conformable. The contact with the overlying Catahoula formation may be conformable in some localities as the dark-gray, plastic clays of the Bucatunna merge upward into silty clays of the Catahoula without any apparent break. The wide variation in thickness of the Bucatunna may indicate pre-Catahoula erosion in some areas.

Continuous weathering of the Bucatunna renders it almost unrecognizable and there are few good outcrops of Bucatunna in the County. The best exposure is a hillside west of Interstate Highway 55, 0.4 mile north of the Byram interchange in NW.¼, Sec.13, T.4N., R.1E., where about 15 feet of chocolate-brown clays shown in Figure 25 are seen. Another exposure is in a roadcut on the east side of a north-south road just south of a juncture with an east-west road in extreme northeast corner Sec.11, T.5N., R.2W., where weathered Bucatunna clays overlie badly weathered Byram marl and Glendon limestone. The Bucatunna is exposed below silty Catahoula clays in roadcuts on both sides of a north-south road 0.2 mile south of Baker Creek in SW.¼, Sec.12, T.5N., R.3W.

Descriptions of the lithology of Bucatunna and thickness of the unit in various localities can be found in the test hole records of Holes AF-1 or 1A, 3, 5, 7, 9, 11, 12, 13, 26, 37, 52, 53, 56, 57, 62 and 63.

The Bucatunna clay contains a few fossils in its lower few feet over most of the Hinds County subsurface. In the area where marls are present in the Bucatunna, abundant microfauna were observed. The Bucatunna is unfossiliferous on the outcrop.

UNUSUAL SAND BODIES IN THE CATAHOULA-VICKSBURG SECTION

In the examination of the electrical logs of core holes contributed to the Survey for the Hinds County project, it was noticed that some of these logs contained a section with the electrical characteristics of a sand in the stratigraphic position normally occupied by clays, marls and limestones of the Vicksburg group. Notations on these logs made by contributing company personnel frequently read "no Vicksburg lime in this hole."

One area where this condition is present is some two miles east of Raymond. In an effort to determine the extent of this sand section and to try to determine its correct stratigraphic position, Hole AF-50 was drilled 2112 feet from the south line and 2600 feet from the west line of Sec.23, T.5N., R.2W. This hole was drilled to a depth of 400 feet bottoming in the Yazoo clay. Careful sampling procedures were followed during the drilling of the hole and cutting samples were taken at 5-foot intervals through the critical section.

This hole penetrated a section of Catahoula clays, silts and thin sands to a depth of 190 feet at which position a sand body was encountered which persisted to a depth of 284 feet with a clay break from 240 to 258 feet. This sand is gray, fine-grained at the top and increasing in grain size to coarse-grained at the base. The sand is non-fossiliferous and non-glauconitic. It contains many black or dark grains of chert, smoky quartz and heavy minerals. Beneath this sand at 284 feet Forest Hill clays and sands were encountered.

The existence of the sand body definitely was established by the drilling of AF-50 but the problem of the extent and stratigraphic position had not been settled. AF-52 was then drilled approximately one mile to the west in the center of the N.½ of SW.¼, SE.¼, Sec.22, T.5N., R.2W. This hole encountered a normal Vicksburg section of Bucatunna clay, Byram marl, Glendon limestone and Mint Spring marl. AF-53 was then drilled a little over a mile east of AF-50 in the NW.¼, SE.¼, Sec.24, T.5N., R.2W. AF-53 also encountered a normal Vicksburg section. Sometime later AF-62 was drilled about one-half mile west of AF-50 in the NW.¼, SW.¼, Sec.23, T.5N., R.1E. As in AF-52 and 53 a normal Vicksburg section was present.

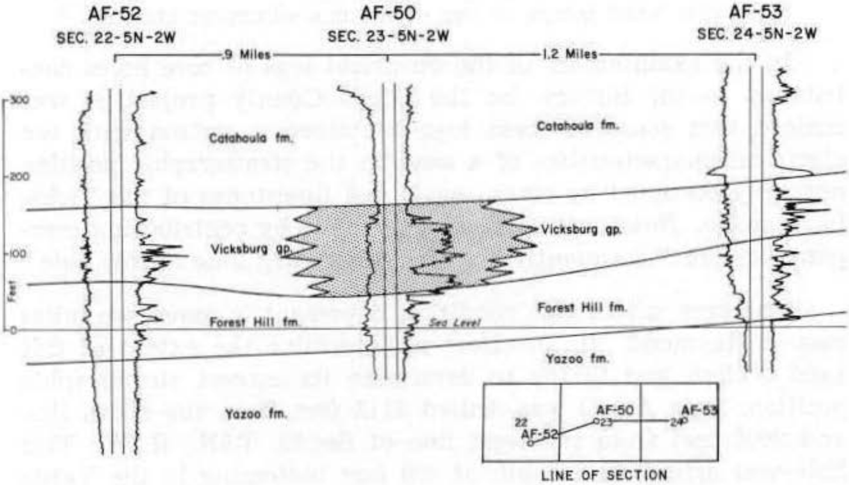

Figure 26.—Stratigraphic section showing unusual sand body in stratigraphic position of the Vicksburg group.

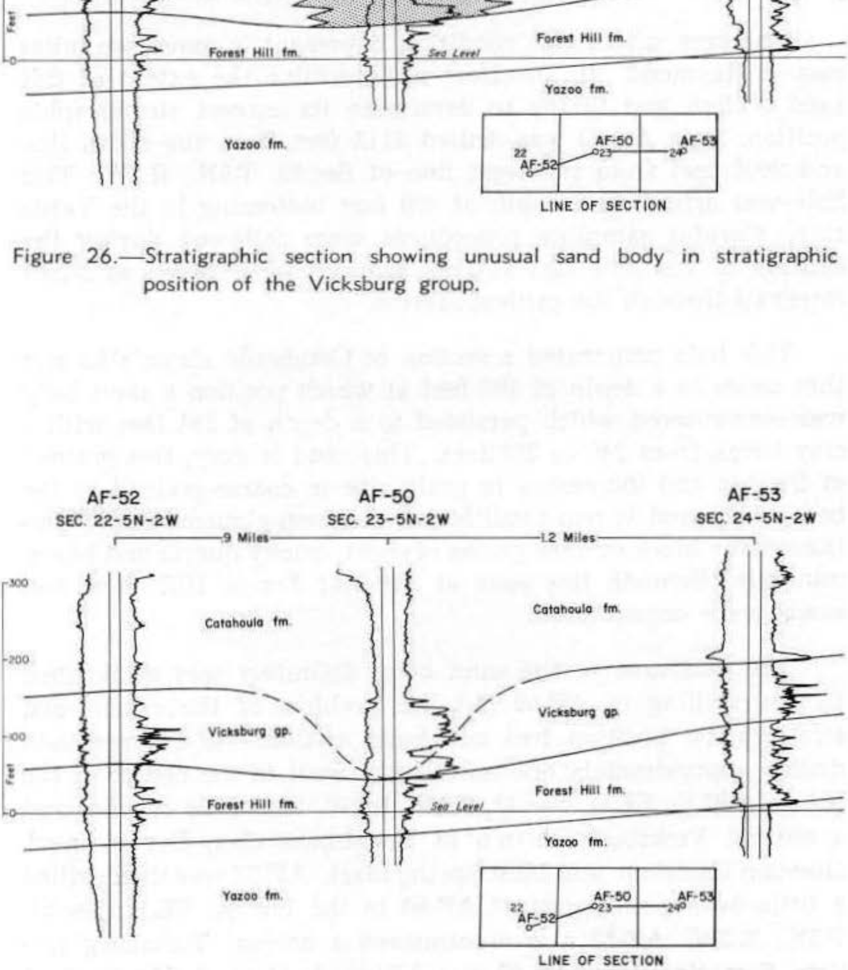

Figure 27.—Stratigraphic section showing unusual sand body as a Catahoula channel sand.

The areal extent of the sand body had now been somewhat defined in two directions. Further definition of the areal extent can be made with the knowledge that the Vicksburg group crops out about a mile and one-half north of AF-50. The stratigraphic position of the sand had not been established as the sandy body was not found overlain by any Vicksburg sediments nor did it contain fossils, glauconite, etc. The sand was similar in lithology to Catahoula sands examined in cuttings from other holes.

Figure 26 and Figure 27 show two interpretations of the stratigraphic position of the sand body. Interpretation 1 places it in the Vicksburg. As the Vicksburg is a sequence of marine units, the sand body would, by necessity, be of the nature of an offshore island. Interpretation 2 places the sand in the Catahoula. The Catahoula is a non-marine unit in Hinds County and the sand would be a thick channel sand, perhaps a point bar deposit.

Some five miles southwest of AF-50 a water well was drilled on the R. E. Douglas property in the SE.¼, NE.¼, Sec.13, T.4N., R.3W. A sand section some 120 feet thick was encountered lying directly on the Glendon limestone. Hole AF-5 drilled one and one-half miles northwest of the Douglas well in SE.¼, SW.¼, NE.¼, Sec.11, T.4N., R.7W., encountered a normal Catahoula and Vicksburg section. The sand body in the Douglas well appears to be a Catahoula channel sand which has cut out the Bucatunna clay and Byram marl. In the discussion of unusual sand bodies, it seems well to mention two thick surface deposits. The locations of these sands are: on McRaven Hill in Secs. 5, 6, 7, 8 of T.5N., R.1W., and on Sand Hill north of Kickapoo Lake in Sec.31, T.7N., R.1W. These deposits are 70 to 80 feet thick, are overlain by loess and overlie Forest Hill clays and silts. They are designated as pre-loess terraces on the Geologic Map of the County. The writer is of the opinion that they are terrace sands but it must be pointed out that they lie on the Forest Hill sand as does the sand in AF-50 and that they are unusually thick for terrace sands. At Sand Hill an outlier of the Glendon limestone is found on the northeastern slope of the hill at an elevation of 370 feet. Hole AF-25 was drilled on top of Sand Hill to determine the thickness and stratigraphic position of this limestone ledge. No limestone was found in the hole, nor was the Mint Spring marl present. Clays of the Forest Hill were overlain directly by the thick sand body. The electrical log of AF-25, showing the thickness and stratigraphic position of the sand body is seen on Plate 2.

CATAHOULA FORMATION

The name "Catahoula" was proposed by Veatch[53] in 1905 for exposures in Catahoula Parish, Louisiana. The Catahoula outcrop area covers the southern half of the County and much of the northwestern segment. It is overlain by terrace deposits and loess over a good portion of its outcrop belt, forming some of the more rugged topography found in the County.

The Catahoula consists of gray to white, very fine- to coarse-grained sands, locally indurated in varying degrees to form sandstones; gray, tan and white silts and siltstones; gray, green, buff and purple, very silty clays, and clayey silts and some gray to buff, slightly silty clay. The sands contain much kaolinitic interstitial material accounting for the white color. Some of the sandstones, particularly the fine-grained ones, and siltstones are extremely indurated on the surface or very near the surface. At depth these sands and silts are not noticeably hard. The hard but discontinuous beds of sandstone form heavy ledges which furnish many good outcrops over the County. They are interbedded with clays and silts. Ledges 3 feet in thickness may pinch out in a short lateral distance. Figure 28 shows interbedded sandstones and clayey silts near Bear Creek Church in NW.¼, Sec.32, T.3N., R.3W.

The complete thickness of Catahoula is not present in Hinds County as its upper contact with the Hattiesburg clay is some distance south of the County. The maximum thickness present is about 500 feet in the southwestern portion of the County. Hole AF-10 located some 10 miles slightly north of east from the southwestern corner of the County penetrated 455 feet of Catahoula sediments.

The contact of the Catahoula with the underlying Bucatunna was observed at several surface localities and in cores from 6 holes. The contact appears to be conformable in some instances as the dark-gray clays of the Bucatunna merge upward into the lighter-colored silty clays and silts of the Catahoula with no apparent break. In some instances the contact

Figure 28.—Interbedded Catahoula sandstones and clayey silts exposed in roadcut on State Highway 27 near Bear Creek Church in NW.¼, Sec.32, T.3N., R.3W. Perry Nations photo. March 5, 1965.

may be disconformable as evidenced by an abrupt change from dark-gray, plastic Bucatunna to sandy, lignitic clays and lignitic sand. Further evidence of disconformity is the highly variable thickness of the Bucatunna which may indicate pre-Catahoula erosion. In localities where a thin Bucatunna section is encountered an unusual clay frequently is present a few feet above the top of the Bucatunna. This clay is bright green in the unweathered state and weathers to a tan or yellowish color. It is tough, blocky and caves very readily into drill holes which penetrate it frequently forming great mounds of cuttings when pumped from the bore holes. This clay is bentonitic in appearance and has been tested by two competitive clay industries for possible use as a bleaching clay or as a foundry bond clay. The economic aspects of this clay are discussed in the section on Economic Geology. This clay appears to have been deposited in erosional "lows" over the Bucatunna.

The Catahoula is essentially a sequence of non-marine deposits. The samples from a few holes indicate thin glauconitic sands are present some 50 feet above the top of the Bucatunna. It is not known if the sands may be the western equivalent of the Paynes Hammock formation. No fossils were observed in the Catahoula of Hinds County. A few plant fossils have been found in the Catahoula in other areas. These flora have been described by Berry[54]. Possible animal fossils in the form of obscure prints in sandy clay were discovered in Simpson County by Henry N. Toler in 1931.

Figure 29.—Silty Catahoula clay exposed in roadcut on south side of U. S. Highway 80 in NE.¼, Sec.22, T.6N., R.2W. November 5, 1963.

There are many good outcrops of Catahoula clays in the County. The clays and clayey silts are typified by the gray, very silty clay shown in Figure 29. The locations of some 11 core holes which sampled the Catahoula clays for testing are shown on the Mineral Resources Map. Also there are numerous outcrops of Catahoula sandstones as shown in Figure 28. The sandstones frequently are quite kaolinitic and are white in color. The white sandstones are exposed typically in a roadcut on U. S. Highway 80 west of Clinton (Figure 30).

Descriptions of the lithology of the Catahoula in numerous localities can be found in the test hole records of Holes AF-1

Figure 30.—White, kaolinitic Catahoula sandstone exposed on north side of U. S. Highway 80 just south of center of Sec.23, T.6N., R.2W. Perry Nations photo. March 5, 1965.

and 1A, 3, 4, 5, 9, 10, 11, 12, 13, 14, 27, 28, 29, 30, 32, 33, 34, 35, 36, 37, 46, 47, 48, 50, 52, 53, 56, 57, 58, 59, 60, 61, 62 and 63.

CITRONELLE FORMATION

The Citronelle formation was named by Matson[55] in 1916 for exposures around Citronelle, Mobile County, Alabama. Although this may be an incorrect application of Matson's original definition, the term "Citronelle" has been applied to most of the graveliferous deposits over much of the State. There has been much argument as to the age of the Citronelle, whether it is Pliocene or Pleistocene. Without a review of all arguments given and positions taken on this subject, the Citronelle is assigned to the Pleistocene in this report.

Rather than include all pre-loess gravels in the Citronelle only a few deposits found at elevations from 440 to 460 feet along the southern portion of the Pearl-Big Black divide are designated as Citronelle. Doering[56] indicated that the base of the Citronelle is encountered at successively higher elevations from south to north in Mississippi. Doering's maps indicate that the Citronelle would be found at elevations of around 450 feet in southern Hinds County and at greater elevations if any farther north. It is on the basis of elevation that the few deposits shown on the Geologic Map as Citronelle have been selected. No great variation in particle size or composition could be detected in the gravel deposits found at several levels in the County, excepting present alluvial plains and stream beds.

The base of the Citronelle deposits in T.3N., R.2W. is at about 440 to 450 feet. The northernmost Citronelle deposit on the hill above Coopers Wells in Sec.35, T.4N., R.2W. is found above 460 feet. A small deposit of gravel and sand capping a hill north of Forest Hill School in Sec.15, T.5N., R.1W. lies above 475 feet and may be Citronelle also though not so designated in this report. The top of this hill at 488 feet is the highest elevation in Hinds County.

PRE-LOESS TERRACE DEPOSITS

All sand and gravel deposits, excepting the Citronelle, and the sands and gravels found in present-day stream beds and alluvial plains are designated as pre-loess terrace deposits and are considered to be Pleistocene in age.

These deposits lie at several levels and are remnants of a more or less continuous deposit which covered the County—possibly the Citronelle. These deposits are found in most areas of the County but are more extensive in the southwestern portion of the County, along the Pearl-Big Black divide, and in the hills above the Pearl and Big Black Rivers. These deposits are found overlying almost all the geologic units in the County and are in turn overlain by the loess. Figure 31 shows terrace gravels and sands lying on clayey silts of the Catahoula and beneath the loess.

The deposits are made up of gravel, fine- to coarse-grained sand and occasional clay lenses. The gravels are chert predominantly with some quartz. The sands are stained red on the surface and the clays are red, yellow, pink, buff and purple in color. The higher level deposits usually are more graveliferous and the lower deposits predominantly sand.

The highest level deposits lie above 400 feet. They are found along the southern portion of the Pearl-Big Black divide and in the higher hills in the southwestern corner of the County. These deposits contain gravel, sand and clay.

Figure 31.—Terrace gravel and sand overlying Catahoula silts and overlain by loess. Exposed in roadcut in NW.¼, SW.¼, Sec.17, T.4N., R.4W. Perry Nations photo. March 5, 1965.

Eastward from the Pearl-Big Black divide lower terrace deposits are found. One lies above 360 feet. It contains some gravel in the southern portion of the County but in and around Jackson it is almost entirely sand. A lower terrace lies above 320 feet and is made up of sand. In the Jackson area in the outcrop belt of the Yazoo a thin gravel bed is found at the base of the weathered loess or "brown loam." It rests on the Yazoo and is from a few inches to one foot thick. It is not shown in the pre-loess deposits on the Geologic Map. Figure 32 shows this thin gravel bed.

Two sand deposits some 70 to 80 feet thick located on McRaven Hill south of Clinton and on Sand Hill north of Camp Kickapoo have been discussed previously under the heading "Unusual Sand Bodies in the Catahoula-Vicksburg Section."

Figure 32.—Thin gravel bed between Yazoo clay and brown loam exposed in roadcut in SW.¼, Sec.7, T.6N., R.1E. Perry Nations photo. March 11, 1965.

West of the Pearl-Big Black divide lower terrace deposits are found at levels of 360 feet and just above 300 feet. These deposits are somewhat discontinuous except in the southwestern portion of the County where they cap almost every hill and ridge. They appear to be continuous deposits from above 400 feet to just above 300 feet but close examination discloses the several levels.

In the bluffs overlooking the Big Black River deposits of sand and gravel are found at levels down to below 200 feet. Some of these deposits may be as much as 50 feet thick but 20 to 30 feet is a more consistent thickness.

Specific locations of some deposits are given in the section on Economic Geology and a majority of the other pre-loess deposits in the County can be located by the use of the Geologic Map of Hinds County.

The pre-loess terrace deposits were not found to be fossiliferous in Hinds County but silicified wood is commonly found at the contact of the terrace deposits and the Forest Hill formation. Figure 33 shows several large silicified logs collected from terrace deposits. These logs are now on the lawn of the W. C. Deviney home.

LOESS

Much of Hinds County is covered by a mantle of loess or its weathered equivalent the "brown loam." The Geologic Map shows the western portion of the County to be covered by loess

Figure 33.—Silicified logs on lawn of W. C. Deviney home in NW.¼, NE.¼, Sec.18, T.5N., R.1W. Perry Nations photo. March 11, 1965.

generally thicker than 10 feet. To the east the loess and brown loam is still present but thinner than 10 feet.

In western Hinds County the loess may be up to 30 feet thick and is found in the typical steep bluffs and vertical roadcuts. It contains land snail shells. To the east the loess presents a more subdued and weathered appearance and is called the "brown loam." Some loess has been eroded, moved a short distance down slope and redeposited. These reworked loessal silt deposits are as much as 20 feet thick in some localities and are found usually as the first topographic terrace above an alluvial plain.

ALLUVIUM

Not shown on the Geologic Map of the County are extensive deposits in the alluvial plain of rivers, creeks and smaller streams. These deposits may cover the bedrock strata with gravel, sand, silt and clay in thicknesses up to 80 feet along the Big Black River. The widest alluvial plains are along the Big Black and Pearl Rivers and may be up to three miles wide. The alluvial plains of some creeks are one to two miles in width.

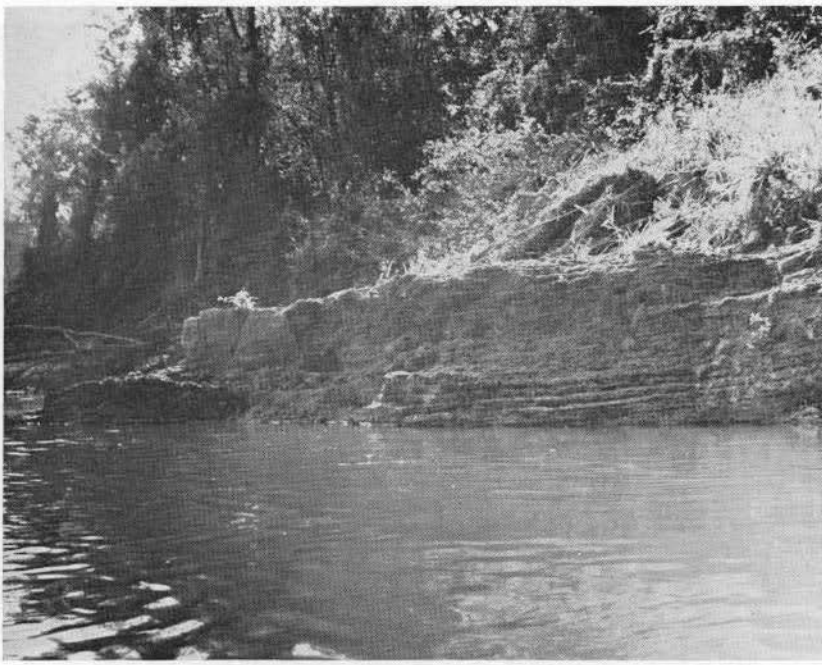

Figure 34.—Dip in alluvium (slump) in west bank of Pearl River in Sec.36, T.6N., R.1E. Perry Nations photo. September 22, 1964.

The alluvium is generally stratified with gravel at the base and followed by sand, sand and silt, and in some cases, clay. The alluvium of the Big Black and Pearl Rivers also contains much organic material.

The alluvial deposits are laid down in an essentially horizontal plane. Slumping of these deposits along the banks of streams produces very local dips. Figure 34 shows slumped alluvium in the west bank of the Pearl River which exhibits apparent dip.

STRUCTURE

Hinds County lies on the east flank of the portion of the Gulf Coast Geosyncline commonly referred to as the Mississippi Embayment. The axis of this syncline passes in a north-south direction roughly along the western boundary of the County. The Embayment syncline plunges to the south and regional dip in Hinds County is to the southwest. This regional dip is interrupted by the major structural feature in Hinds County, the Jackson Dome.

The Jackson Dome is located in northeastern Hinds County and adjoining Rankin and Madison Counties. The crest of the Dome is within the City of Jackson. This structural feature has been recognized for over one hundred years and several reports have discussed this structure. The structural and stratigraphic relationships of the surface formations on the Jackson Dome are adequately demonstrated on Plate 2, the Stratigraphic-Structural Cross Sections of the Jackson Dome.

Plate 3 is a stratigraphic-structural cross section from the crest of the Jackson Dome to the southwestern corner of the County. This plate shows the relationship of surface and shallow subsurface units to regional dip.

In the northwestern portion of the County beds of the Forest Hill formation are exposed in creek beds in Secs.26, 27, 34 and 35 of T.7N., R.4W. at elevations higher than normally would be expected. This indication of local structural uplift is substantiated by structural maps compiled by Alvin R. Bicker in the section "Hinds County Structural Geology." Several oil test wells have been drilled on this structure.

In the southern half of Secs. 19 and 20, T.5N., R.3W., the Bucatunna clay is present beneath the alluvium of Turkey Creek. This indicates slight uplift as beds of the Catahoula formation normally would be expected to be present beneath the alluvium in this locality. Bicker's maps indicate a nosing in this area just west of the Oakley Salt Dome.

The geologic map of the State published by the Mississippi Geological Society in 1945 indicates a surface fault in Secs.11 and 12, T.5N., R.4W. The existence of this fault has been proved by core holes and oil tests. The poor condition of the outcrops in this area did not permit the writer to observe definite surface indications of this fault.

Numerous small slump faults in the Yazoo clay and minor changes in dip of other surface beds are judged to be inconsequential. The structural geology of the County is adequately covered by the maps and text prepared by Bicker.

ECONOMIC GEOLOGY

GENERAL STATEMENT

In the investigation of the geology and mineral resources of a county, economic considerations are of utmost importance. One of the chief purposes of the Hinds County investigation was to locate and report mineral deposits of known or probable economic value. In the field observation of outcrops, the idea of possible utilization of the rocks examined was kept in mind. Of the 63 holes drilled and/or cored in the course of the investigation, 35 of them yielded samples for various testing procedures. In addition to these 35, other holes were of value in delineating areas favorable for further sampling. The preceding sections on Geomorphology, Stratigraphy and Structure add to the overall understanding of the mineral deposits by helping to supply the answers to questions of where, when and why these deposits are present.

Some of Hinds County's mineral resources are now being utilized or have in the past been utilized. A history of these mineral industries and their production is discussed in the section on "Hinds County Mineral Industries" by William S. Parks.

CLAYS AND NATURAL CLAY MIXTURES

Clays and clay-like materials are abundant in Hinds County and are one of the County's important mineral resources. Two industries are presently utilizing Hinds County clays and further development of clay utilization is worthy of consideration. The term "clay" commonly covers a wide range of chemical and physical compositions, and it seems proper at this time to define clay. The writer realizes that all materials selected for ceramic and physical testing under the heading of clays do not meet the chemical and physical requirements of a clay. Grim[57] in his text on clay mineralogy defines clay as "a rock term and also a particle-size term in the mechanical analysis of sedimentary rocks, soils, etc. As a rock term it is difficult to define precisely, because of the wide variety of materials that have been called clays. In general the term clay implies a natural earth, fine-grained material which develops plasticity when mixed with a limited amount of water. By plasticity is meant the property of the moistened material to be deformed under the application of pressure, with the deformed shape being retained when the deforming pressure is removed. Chemical analysis of clays shows them to be essentially silica, alumina and water, frequently with appreciable quantities of iron, alkalies and alkaline earths . . . As a particle size term, the clay fraction is that size fraction composed of the smallest particles. The maximum size of particles in the clay size grade is defined differently in different disciplines. In geology the tendency has been to follow the Wentworth scale and to define the clay grade as material finer than about 4 microns."

Only a few of the samples selected for testing meet all the requirements for a clay with some of them being more properly classified as silts and others being very silty clays and some silty, sandy clays. The term "natural clay mixtures" would seem appropriate for them as they exhibit some of the properties of clays without having artificial materials added.

Field exposures of clays and natural clay mixtures were studied and the lithologic character, accessibility and where possible, the thicknesses were noted. Additional information was obtained from samples and electrical logs of the Survey's core holes. Twenty core holes were drilled and samples were obtained for testing. Three separate samples were selected from one hole making a total of 22 samples. Of these samples, 3 were from the Yazoo clay, 2 from the Bucatunna clay, 11 from the Catahoula formation, 1 from a pre-loess terrace deposit and 5 from loessal silt.

The ceramic tests were conducted by Thomas E. McCutcheon, Ceramic Engineer, in the laboratories of Georgia Institute of Technology. In conjunction with the ceramic testing the writer examined and described the residues from screen analysis. Shilstone Testing Laboratory of New Orleans, Louisiana, made chemical analyses of the 22 samples.

In addition to the 22 samples tested for ceramic properties, a lower Catahoula clay found in several of the holes drilled in different parts of the County exhibited bentonitic properties and was tested by two clay industries for possible usage in their processes.

The clays and natural clay mixtures from all geologic units in the County are discussed and reasons for their inclusion in or elimination from the group sampled for testing are given.

Natural clay mixtures of the Cockfield formation crop out in a small area close to the Pearl River and within the City of Jackson. Only a few feet of the upper Cockfield are exposed. The lithologies are gray to buff, fine-grained, silty sands; some lignite, and gray-brown, very silty, sandy, micaceous and carbonaceous clay and clayey silt. The lithologic character of the Cockfield precludes its use in ceramics and other clay products.

The Moodys Branch formation crops out mostly along creeks within the City of Jackson. It is a thin unit made up of glauconitic, fossiliferous, calcareous sand and sandy marl and, while it might be useful in other mineral industries, is not included in the clays and natural clay mixtures.

The Yazoo clay outcrop belt is in the northeastern portion of the County. It is as much as 450 feet thick at the downdip edge of the outcrop belt. The amount of raw material available is almost unlimited and the overburden is in places negligible. The several railroads and highways in the outcrop area make transportation of raw materials and products a simple matter.

The Yazoo clay is predominately a blue-green to blue-gray, calcareous, fossiliferous, montmorillonitic clay. It weathers to a yellowish or greenish-yellow color. It is pyritic in places where unweathered and where slightly weathered is frequently gypsiferous at or near the surface. The Yazoo is slightly silty in places but contains little or no sand. The lower few feet of Yazoo are very calcareous, glauconitic and slightly sandy. The upper 100 feet of Yazoo may contain beds of white, soft, argillaceous limestone. The upper few feet of Yazoo are gray in color in the unweathered state and non-calcareous. Weathering produces a brown to tan color with limonitic staining on fracture surfaces. A very thin bed of bentonite is found in the upper portion of the Yazoo in a few localities. Due to fairly deep weathering, few outcrops of blue-green Yazoo clay are found with even new roadcuts unearthing yellowish clay.

There have been previous tests of the Yazoo clay made in the course of investigations by the Mississippi Geological Survey. Bay[58] reports on the bleaching qualities of the thin bentonite bed in Bulletin 29 "A Preliminary Investigation of the Bleaching Clays of Mississippi." The results of tests published in Bulletin 39, "Yazoo County Mineral Resources" and in Bulletin 49, "Scott County" provided basic information that led to the investigation of the Yazoo clay as a lightweight aggregate material and the establishment of a lightweight aggregate plant in Hinds County. Further tests of lightweight aggregate potential of the Yazoo were made in conjunction with the work on Bulletin 103, "Survey of Lightweight Aggregate Materials of Mississippi." One of the samples tested in this work came from Hole AF-17 drilled and cored during the present investigation.

The upper portion of the Yazoo was selected for testing in this study. Two more prominent outcrops of this upper Yazoo are on the east side of Interstate Highway 55 just south of the Elton Road overpass in SW.¼, NW.¼, Sec.5, T.4N., R.1E. and along an east-west gravel road in SW.¼, SE.¼, NW.¼, Sec.5, T.7N., R.1W. The latter location was selected for sampling and Hole AF-40 was cored to 50 feet. Samples from three intervals in this hole were made for testing. The interval from 8 to 26.5 feet is the non-calcareous clay; 26.5 to 42 feet is from calcareous and slightly fossiliferous clay and 42 to 50 feet is from calcareous, quite fossiliferous clay.

The Forest Hill formation crops out in an irregular, rather narrow belt around the Hinds County side of the Jackson Dome and in a few places in the northwestern corner of the County. The Forest Hill contains some clay and natural clay mixtures but the quantity and quality are not sufficient for use in clay products. The clays are for the most part very silty, sandy, carbonaceous and lignitic.

The Mint Spring marl, Glendon limestone and Byram marl are not considered sources of material for clay products. They contain small amounts of clayey material but are more important sources of other mineral products to be discussed under another heading.

The Bucatunna clay crops out along a narrow belt across the central portion of the County. The Bucatunna is as much as 60 feet thick in some localities. It is a generally homogeneous clay, dark-gray to black, slightly calcareous, glauconitic, pyritiferous with some thin silt and sand laminae. The Bucatunna weathers to a chocolate-brown color with limonitic partings and limonitic staining along fractures.

Good outcrops of Bucatunna are rare. The best of these are:

(1) in the hillside west of Interstate Highway 55, 0.4 mile north of Byram interchange in NW.¼, Sec.13, T.4N., R.1E.

(2) in roadcut on east side of north-south road just south of juncture east-west road in extreme NE. corner Sec.11, T.5N., R.2W.

(3) in roadcuts on both sides of north-south road 0.2 mile south of Baker Creek in SW.¼, Sec.12, T.5N., R.3W.

Samples of the Bucatunna from Hole AF-1A were tested previously and reported in Bulletin 103 "Survey of Lightweight Aggregate Materials of Mississippi." These tests showed the Bucatunna to be an excellent potential raw material for the production of lightweight aggregate.

Samples of Bucatunna from two additional holes were tested for this report. Hole AF-26 located in the center of the NW.¼, Sec.22, T.6N., R.2W. was sampled from 8 to 21 feet. This clay was the chocolate-brown, weathered Bucatunna. Hole AF-37 located in SE.¼, NE.¼, Sec.13, T.4N., R.1E. was sampled from 12 to 60 feet. This interval of the Bucatunna contained both weathered and unweathered clay.

In addition to its potential as a lightweight aggregate material, the Bucatunna of Hinds County is a possible source of another mineral product. In Jasper and Smith Counties the Bucatunna is known as an "acid iron earth." A definition of "acid iron earth" is a clay bearing copperas, an iron sulfate. Several plants in these Counties extract iron sulfate from the Bucatunna for use as a medicine called "Nature's Aid," a livestock feed supplement and a soil conditioner. It is reasonable to assume that the Bucatunna of Hinds County could be utilized in a like manner.

The outcrop area of the Catahoula formation covers more of Hinds County than any other geologic unit. The entire southern half of the County and portions of the northwestern segment are in the Catahoula outcrop area. The Catahoula is as much as 500 feet thick in southern Hinds County. This formation contains few beds which are true clays in the sense of the textbook definition but has many beds containing natural clay mixtures. Several general descriptive types of Catahoula natural clay mixtures are:

(1) light-gray to buff, slightly silty, plastic clays

(2) light-gray to gray, very silty, sandy clay and clayey silt with thin kaolinitic stringers

(3) green to pale-green, silty to very silty clay and clayey silt

(4) Purple to grayish-purple, clayey, silty and very silty clay.

Outcrops of these four types are numerous and 11 locations were selected for drilling of core holes to obtain samples for testing. It was felt that these holes would sample the thickest and most extensive deposits of clays and natural clay mixtures that could be determined from outcrop study and examination of core hole data. Holes AF-27, 28, 29, 30, 32, 33, 34, 35, 46, 47 and 48 sampled the Catahoula. The thickness of these deposits was from 8 to 25 feet.

Chemical analysis of the Catahoula samples showed only two approaching the chemical requirements of a true clay. These two samples were from AF-32 and AF-34.

In addition to the four types discussed previously a less typical clay was encountered in several core holes. It is a green, blocky, tough clay, weathering to tan. It swells readily and resembles a bentonite in this reaction although not as mealy in texture as other Mississippi bentonites.

This clay was first noticed in the drilling of Hole AF-3 at a depth of 50 to 60 feet. To find the clay nearer the surface AF-4 was drilled 50 feet south of center line of U. S. Highway 80 in NE.¼, SW.¼, Sec.23, T.6N., R.2W. The clay was found at a depth of 20 feet in this hole and was about 11 feet thick. The upper 3 to 4 feet were composed of tan, tough, blocky clay with limonite staining on fractures. The lower 7 feet of clay were green, blocky and tough.

One of the three companies in Mississippi producing foundry bond clay tested samples from AF-4 against one of their standard clays and the results were as follows:

	Sample Depth	Green Strength	Dry Strength
Standard clay		13.4	57
Samples from AF-4	20-22′	8.0	64
	22-24′	10.6	65
	24-26′	9.0	49
	26-28′	9.7	38
	28-30′	8.2	42
	30-32′	8.4	47

One industry producing bleaching clays tested a composite sample from AF-4 from the depths of 26 to 32 feet and found this clay to be 77 percent as efficient as their standard test clay.

On the basis of these tests additional holes were drilled near AF-4 to determine the possible extent of the deposit. Holes AF-59, 60, and 61 encountered thicknesses of 10 to 16 feet of tan, blocky, tough clay. These holes proved a deposit covering more than 100 acres. The top of the clay was encountered at about 290 feet above sea level. If attention is paid to topography the clay can be reached with a minimum of overburden. This clay occupies a stratigraphic position just above the Bucatunna-Catahoula contact and has been noticed in cuttings from other holes. It was observed in the cuttings from a water well drilled on the C. F. Grant property on the north side of State Highway 18 in SW.¼, SW.¼, NW.¼, Sec.28, T.5N., R.1W. In order to sample the clay at this locality Hole AF-63 was cored 200 feet north of the Grant water well, and 11 feet of tan, tough, blocky clay were found with the top of the clay at 335 feet above sea level.

Additional tests for bond clay properties were made on composite samples from AF-59, 60 and 61 along with a sample of non-calcareous upper Yazoo clay from Hole AF-40. These results as compared with a standard clay are as follows:

	Green Strength	Dry Strength
Standard clay	13.4	54
Samples from AF-59	9.2	63
AF-60	9.4	63
AF-61	10.3	60
AF-40	8.6	47

The results of sampling of clays from these five holes show that a clay of considerable areal extent and adequate thickness for mining exists. The tests indicate that this clay has properties which may make it desirable as a foundry bond clay and possibly a bleaching clay. The tan oxidized clay has greater bonding strength while the green, unoxidized clay is more efficient as a bleaching clay. More detailed locations, elevations and descriptions of strata on these five holes are contained in the section "Test Hole Records." The holes also are spotted on the Mineral Resources Map found in the pocket.

The pre-loess terrace deposits locally contain lenses of clay. These lenses are usually of small areal extent but may be as thick as 10 to 15 feet. Hole AF-31 located in the south end of a gravel pit in SE.¼, NE.¼, SE.¼, Sec.23, T.4N., R.4W. was cored to sample a terrace deposit. This sample was made up of red, gray and pink, silty clay with sand laminae.

The typical loess which produces vertical bluffs and contains snail shells has been tested in several previous bulletins and was not tested in this investigation. Tests were made on material from five holes in the loessal silt which is derived from weathering and in some cases erosion and redeposition of the silt at a lower level. Holes AF-41 through AF-45 were cored to sample the loessal silt. The samples were from deposits 14 to 21 feet in thickness. These deposits are made up of brown, tan and gray silt, usually manganiferous in the upper part.

The alluvial plains of the Big Black and Pearl Rivers and other streams may contain deposits of clay and natural clay mixtures, but they were not sampled in the course of this study.

SAND AND GRAVEL

The need for sand and gravel as topping for roads and in the construction industry is especially critical in the rapidly growing Hinds County area. Hinds County lies just north of the extensive gravel deposits in the Citronelle formation but contains other sand and gravel deposits which can provide much usable material, particularly for road topping.

There are a few Citronelle deposits in southern Hinds County but most of the gravel is found in pre-loess terrace deposits and some in stream alluvium.

With the use of the Geologic Map of Hinds County accompanying this Bulletin and topographic maps of the County, the sand and gravel deposits can be located quite accurately. Of course some of the gravel and sand deposits have been known and exploited for some time and several pits have been exhausted. Data on many of the pits as to amount and quality of materials are given in the section "Hinds County Mineral Resources."

Figure 35.—Gravel pit in pre-loess terrace deposits in SE.¼, SE.¼, Sec.15, T.6N., R.4W. Perry Nations photo. March 5, 1965.

Citronelle gravel deposits are found capping some of the higher hills in Townships 3, 4 and 5 North, Range 2 West. The base of the Citronelle is at 440 to 460 feet. The percentage of gravel in these deposits is high but the deposits are not extensive. Pre-loess sand, clay and gravel deposits cap the lower hills in the area of the Citronelle outcrops but the percentage of gravel in these deposits is lower.

Other pre-loess terrace deposits containing some gravel are found. These locations are: in the hills north of old Byram; capping the higher hills just north of Forest Hill; in the Chapel Hill area about two miles south of Bolton; near the Madison County line in Sections 4 and 9 of Township 7 North, Range 2 West; on Champion Hill and the hills just south in the southwestern portion of Township 6 North, Range 3 West; in Sections 5, 6, 7 and 8 of Township 6 North, Range 3 West; the extensively prospected deposits just north of Edwards in Sections 14, 15, 22 and 23, Township 6 North, Range 4 West (Figure 35); one mile northwest of Adams Station in Township 4 North, Range 4 West; one-half mile west of St. John Church in Section 17, Township 3 North, Range 3 West.

The locations described above are more or less isolated deposits made up mostly of sand and clay with some gravel. The deposits north of Edwards are the most graveliferous.

In addition to these deposits the hills in the southwestern portion of the County are for the most part capped with pre-loess terrace deposits beneath the loess. These deposits contain some gravel in almost every case. The most extensive of these gravel-bearing areas is southwest of Utica in the area called the "Scutchalo Hills." Holes AF-14, 15, and 16 were cored in the southwestern portion of the County to obtain samples of gravel sand and clay for testing. The samples from 11 to 14 feet in Hole AF-14 and 14 to 22 feet in Hole AF-16 were sent to Mississippi Testing Laboratories for mechanical analysis. The results of these analyses as compared with the standard used by Mississippi State Highway Department are shown in Table 2.

Some of the pre-loess deposits are made up almost entirely of sand. These deposits are valuable for topping material even though they contain no gravel. The thickest and more extensive of these sand deposits are: just south of McRaven in Sections 5, 6, 7 and 8 in Township 6 North, Range 1 West; the hills near Kickapoo Camp and Lake in Section 31, Township 7 North, Range 1 West and Sections 5 and 6 in Township 6 North, Range 1 West; in the hills along the eastern edge of Township 7 North, Range 1 West. The sands at McRaven and at Kickapoo are over

50 feet thick. Another extensive sand deposit is at Taylorsville in Section 31, Township 4 North, Range 1 East. This deposit has been exploited for many years but still contains usable material.

Table 2
Mechanical Analyses of Gravel Samples
by Mississippi Testing Laboratories

	Hole No. AF-14 (11-14')	Hole No. AF-16 (14-22')	Miss. State Highway Dept. Specifications Type "SC"
Mechanical Analysis of Samples:			
(Sieve Size, % Passing)			
1½"	100.00	100.00	95-100
1"	91.80	97.50	75-100
¾"	83.90	92.30	———
½"	79.60	86.50	45-90
No. 4	57.90	69.60	30-63
No. 10	47.70	60.10	25-60
Binder:			
No. 10	100.00	100.00	100.00
No. 20	———	———	———
No. 40	88.90	81.50	20-90
No. 60	75.00	53.70	15-75
No. 140	———	———	———
No. 200	46.60	28.70	———
No. 270	44.80	27.50	8-50
% Clay	23.00	16.00	5-25
% Silt	21.80	11.50	3-25

There may be local deposits of sand and gravel in the alluvial plains and stream beds of some of the creeks and rivers in the County but for the most part they are of doubtful commercial value. Some gravel has been mined from White Oak Creek in southwestern Hinds County but at the present this operation has been discontinued. The sand bars of the Pearl River have furnished small amounts of sand to small operators and one deposit was tested for use as a glass sand. The results of this test were not encouraging.

The Forest Hill formation contains some beds of sand. These beds are usually thin, contain much silt and carbonaceous material and are not considered to be of commercial importance. The Catahoula formation also contains sand beds but on the surface they are indurated and difficult to mine. They may be of use in other fields and this use will be discussed under another category.

LIMESTONE AND MARL

Rocks of the Vicksburg group which crop out in the hills around the Jackson Dome and in much of the northwestern portion of the County contain several beds of limestone and marl. The Moodys Branch formation which crops out in Jackson can be classed as a marl or marly sand.

The use and possible use of limestone and marl in various mineral industries have been pointed out in several of the bulletins of the Mississippi Geological Survey. These are in the manufacture of Portland cement, the manufacture of rock wool and use as agricultural lime. The lime rocks of Hinds County are suitable for all these uses. There are established plants manufacturing cement from the Glendon limestone at Brandon in Rankin County and at Redwood in Warren County. The close proximity of these two plants makes the establishment of a cement plant in Hinds County seem unfeasible at this time. With the great anticipated growth of the Jackson area in population and industry perhaps a future market will arise for cement products and a plant then can be opened to use the raw materials available in the County.

The need for use of limestone and marl as agricultural lime has been discussed several times by Mellen[59] and others. Hinds County would seem to be a good area for the development of another agricultural lime plant. A small plant for production of agricultural lime from the Glendon limestone operated for a short time just east of McRaven.

It has been known for many years that good rock wool could be produced from impure limestone and marls such as are present in Hinds County. A discussion of the possibilities of producing rock wool from rocks of the Vicksburg group in Warren County is discussed in Bulletin 43 "Warren County Mineral Resources," and the ideas given in this report are applicable to Hinds County. T. E. McCutcheon in 1945 produced good rock wool in the Mississippi Geological Survey's laboratory from the Selma chalk from near Tupelo, Lee County. The results of this study were published in Bulletin 62, "Rock Wool."

Another possible source of raw material for rock wool manufacture is the lower Yazoo. It is known that the lower Yazoo is very limy and, in some instances, approaches the chemical composition and hardness of limestone. In Bulletin 49 "Scott County," McCutcheon suggests that the lower Yazoo could be utilized by blending with sand and lime. The mixture could then be formed into "bricks" and stored for subsequent use as in the production of rock wool.

A composite sample of lower Yazoo from 10 feet to 44 feet in AF-17 was analyzed and the analysis published in Bulletin 103. This analysis is as follows:

Hole AF-17

(10-44')

Chemical Analysis in Percent

SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	SO_3	P_2O_5	Cl	Ign	Total
34.19	15.03	4.84	1.94	21.33	0.87	0.89	0.29	0.14	Nil	20.84	100

A foot-by-foot analysis of the lower Yazoo from 13-42 feet in AF-17 was made by Dr. M. P. Etheredge, State Chemist, to determine $CaCO_3$ content. The results of this analysis are shown in graphic form in Figure 36. The lower 4 feet of Yazoo analyzed averaged more than 60 percent $CaCO_3$ and the average for 29 feet is 36.11 percent. The chemical analysis of this would seem to be typical of the lower Yazoo in Hinds County. This limy material can be found at localities other than near AF-17, where mining conditions are more desirable.

With the raw materials available and the use of much insulating material in the building industry around Jackson it seems logical that a rock wool manufacturing plant would be established. At present all insulating material used in the Hinds County area is imported.

In order to supply data for use in the possible establishment of a plant using limestones and marls for the reasons previously mentioned, the Vicksburg limestones and marls were sampled in several localities. The samples were sent to Dr. Etheredge for chemical analysis. The results of these analyses are shown in Table 3.

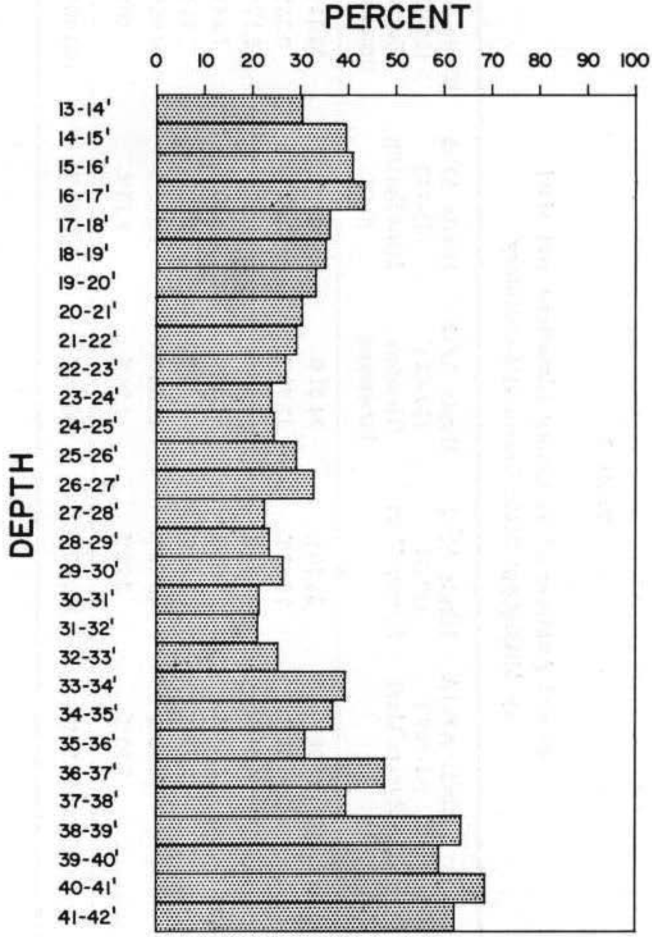

Figure 36.—Comparison of percent $CaCO_3$ in lower 29 feet of Yazoo clay from Hole AF-17.

Table 3

Chemical Analyses of Vicksburg Limestone and Marl
by Mississippi State Chemical Laboratory

	Hinds AF-1A (95-107′) Byram Marl	Hinds AF-2 (17-30′) Byram Marl	Hinds AF-2 (30-62′) Glendon limestone	Hinds AF-2 (62-74′) Mint Spring marl	Hinds AF-51 (25-45′) Glendon limestone	Hinds AF-56 (80-109′) Glendon limestone
Loss on Ignition	33.98%	36.90%	34.01%	16.72%	38.32%	36.70%
Silica (SiO_2)	15.81%	10.42%	17.78%	53.22%	8.20%	12.23%
Iron Oxide (Fe_2O_3)	4.94%	4.74%	2.96%	2.77%	2.17%	2.77%
Aluminum Oxide (Al_2O_3)	2.97%	2.68%	1.95%	4.23%	1.84%	1.50%
Magnesium Oxide (MgO)	2.45%	2.32%	1.61%	1.18%	1.21%	1.04%
Calcium Oxide (CaO)	36.90%	40.72%	40.65%	18.73%	46.60%	44.80%
Undetermined	2.95%	2.22%	1.04%	3.15%	1.66%	0.86%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

The Vicksburg limestones and marls were sampled at or near locations thought to be best for quantity of material, availability (lack of overburden) and proximity to rail and/or highway transportation routes. Samples of the Byram marl were taken from Hole AF-1A in Sec.13, T.4N., R.1W. Samples of

Figure 37.—Glendon limestone and marl in south wall of Rocky Creek in NW.¼, SW.¼, Sec.3, T.6N., R.4W. Perry Nations photo. March 5, 1965.

Byram marl, Glendon limestone and Mint Spring marl were obtained from Hole AF-2 in Sec.19, T.4N., R.1E. Both of these holes are located just south of Vicksburg outcrops in the hills north of Byram. These outcrops are very close to the Illinois Central Railroad and this location would be an excellent plant site. Samples of Glendon limestone and marl were taken from Hole AF-51 located in SE.¼, SE.¼, Sec.2, T.5N., R.2W. This hole is a mile east of the site of the agricultural lime plant which operated for a time. This location is on the Yazoo and Mississippi Valley branch of the Illinois Central Railroad and is a possible plant site. The remaining sample of Glendon limestone is from Hole AF-56 located in the approximate center SW.¼, SW.¼, Sec.3, T.6N., R.4W. This location is not as accessible as the others chosen but the thickest outcrop of limestone seen in one place in the County is just north of this hole in the wall of Rocky Creek (Figure 37).

Although no samples were taken in this area, another good location for a lime-producing plant would be just west of Clinton. The Glendon limestone crops out at several places along the highways and railroads in this area.

SALT

There are six known relatively shallow piercement salt domes in Hinds County. The location of these domes is given in the section "Hinds County Mineral Resources." The depth to the salt in these domes is from around 2800 feet to 4200 feet. The uses of salt in Mississippi have been aptly reviewed by Mellen[60] and he points out that salt's chemical applications are practically endless. The salt of Hinds County lies at considerable depth but again considering the great future industrial growth predicted for the area it is a resource to be seriously considered.

BUILDING STONE

The sandstones of the Catahoula formation have from time to time been used in construction. Catahoula sandstone from a quarry in Sections 22 and 23 in Township 5 North, Range 2 West was used in the building of the Old Capitol Building. Due to the variance in induration of the Catahoula, its use as a building stone is probably limited as is the easily weathered Glendon limestone. The Catahoula is used locally for rip-rap around ponds and lakes and infrequently as road metal.

GLAUCONITE

The limestones and marls of the Vicksburg group and the Moodys Branch marl contain varying amounts of glauconite. Glauconite is a complex hydrated iron aluminum silicate which may contain variable small amounts of manganese, magnesium, calcium, sodium and potassium and traces of titanium, vanadium and phosphorus. Glauconite is used as a zeolitic water softener and as a source of potassium for fertilizer. It is thought that the amount of glauconite in the Hinds County beds is insufficient to be of importance at this time.

LIGNITE

Thin beds of lignite are present in the Cockfield and Forest Hill formations and lignitic sand and clay are found in the Catahoula formation. Rather thick beds of lignite have been from time to time reported in the Cockfield and Forest Hill, but the present investigation found no beds over six inches in thickness. These lignite beds do not seem commercially promising.

KAOLINITIC SANDSTONE

The sands of the Catahoula formation are in some localities distinctly white in appearance due to kaolinitic interstitial material. In the course of the geological survey of Warren County a sample of Catahoula sandstone from along Highway 80 two miles west of Clinton was tested. The results of this test as published in Bulletin 43 "Warren County Mineral Resources" is as follows:

Screen Analysis of the Catahoula Sand, Hinds County

Through Screen	Caught on Screen	Percent
20	30	0.07
30	60	36.48
60	100	34.65
100	150	9.55
150	200	2.26
200	250	0.14
250	cloth	16.85

"The material passing the 250 mesh screen is about 50 percent kaolinite-gibbsite and about 50 percent non-hydrous mineral matter. A considerable percentage of the total kaolinite-gibbsite content of the sample remained on the coarser screens with the sand, partly as closely adhering coatings to the sand grains and partly as hard, white, free grains. McCutcheon estimates not over 15 percent kaolinite-gibbsite in the sample.

"McCutcheon reported in a personal communication that the clay-like substance is a mixture of kaolinite ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$) and gibbsite ($Al_2O_3 \cdot 3H_2O$)."

Outcrops of this kaolinitic sandstone were observed by the writer and Mr. R. S. Sanford, Area Director of the U. S. Bureau of Mines, and it is Mr. Sanford's opinion that these sands are not at this time commercially important.

OIL AND GAS

The discussion of oil and gas possibilities has been placed near the end of the section on economic geology. This is not an attempt to minimize the importance of these minerals but as the Director pointed out in his Foreword, this report does not concern itself with the deep structure and stratigraphy of the County nor is it primarily concerned with petroleum geology. The features pointed out in "Structure" and in the section "Hinds County Structural Geology" may, eventually, be of help in finding new oil and gas deposits.

There have been four oil and gas fields discovered in Hinds County and the production history and present status of these fields is discussed in "Hinds County Mineral Industries." The fact that three of the four fields have been abandoned does not mean that the oil and gas potential of the County has been exhausted. There has been renewed oil and gas activity in the few months previous, particularly in the search for new "Gas Rock" production in the area of Jackson. There also have been several recent wells drilled in the County to test Lower Cretaceous and Jurassic objectives. One of these tests had encouraging shows.

Future studies on the deep stratigraphy and structure of the County will, no doubt, be of aid in the continued search for oil and gas and it is probable that new oil fields will be discovered in the not too distant future.

SUMMARY

Hinds County, as is the case with the other counties of Mississippi, contains no gold, silver or diamonds; nor is it in the area of iron ore deposits, but it does possess mineral resources which can play an important part in the expanding economy of the County.

The data assembled in the sections "Economic Geology" and "Hinds County Clay Tests" along with the discussion of the abundant ground water and surface water resources of Hinds County are not to be considered as final reports on any mineral resource. They are to be used as a basic information with more extensive tests being conducted by parties interested in a particular resource.

ACKNOWLEDGMENTS

The writer wishes to express his appreciation to the Hinds County Board of Supervisors for their support in this project and to the many other local citizens for various help during the course of field work.

Special acknowledgments are due to the various oil companies who furnished many core hole logs for use in the Hinds County project and to the Ground Water Branch of the United States Geological Survey for the furnishing of numerous water well logs and samples.

Acknowledgment is also due Dr. M. P. Etheredge, State Chemist, for chemical analyses of clay, limestone and marl samples.

TEST HOLE AND CORE HOLE RECORDS

Following are the descriptions of cuttings and cores from holes drilled and/or cored in the course of the investigation of the mineral resources of Hinds County. The letters AF preceding the hole numbers are code letters designating Hinds County in the Survey's County Sample Index System. The AF letter designation is used for all holes drilled in conjunction with the Hinds County investigation; although, a few holes were drilled just outside the County's boundaries. When stamped on plastic ceramic test bars the index letters and numbers aid in the permanent indexing and identification of materials tested in the Survey's continuing program of county minerals investigations, begun in 1937.

The purpose for drilling each hole, such as to gain stratigraphic information or to obtain material for various chemical and physical tests, is stated in the heading of each hole along with the information as to whether an electrical log was run on the hole. All thicknesses and depths are in feet.

Hole AF-1 and AF-1A

Location: In southwest quadrant of Byram interchange on right-of-way of Interstate Highway 55 (SW.1/4, SW.1/4, Sec.13, T.4N., R.1W.)

Elevation: 307 feet (hand level) Date: November 20, 1963

Purpose: AF-1 drilled to 260 feet for stratigraphic information and twin hole AF-1A cored to 108 feet to obtain clay and marl for testing and for paleontologic and lithologic studies. Description from cores 0-108 feet; from cuttings 108-260 feet. Electrical log to total depth.

Thickness	Depth	Description
		Catahoula formation
16	16	Clay, tan, very silty, sandy.
18	34	Clay, gray to purple, hard, silty, very sandy in part, limonitic staining in part.
4	38	Sandstone, gray, fine-grained, silty, clayey in part.
		Vicksburg group (Bucatunna clay)
2	40	Clay, gray, slightly silty, finely carbonaceous, with thin silt laminae.
12	52	Clay, dark-gray, plastic, very finely micaceous, with thin laminae of sand, gray, very fine to fine-grained, glauconitic.
38	90	Clay, dark-gray, very finely micaceous, with thin silt laminae in part.
6	96	Clay, dark-gray, very finely micaceous, rare fossils.
		Vicksburg group (Byram marl)
12	108	Marl, gray-green, very clayey, very glauconitic, fossiliferous, slightly sandy in lower part.

		Vicksburg group (Glendon limestone)
2	110	Limestone, gray, fossiliferous, glauconitic.
2	112	Marl, gray-green, very clayey, glauconitic, fossiliferous.
2	114	Limestone, gray, glauconitic, fossiliferous, slightly pyritic.
4	118	Marl, gray-green, fossiliferous, very clayey, slightly glauconitic, limy clay in part.
2	120	Limestone, gray, fossiliferous, glauconitic.
2	122	Marl, gray-green, fossiliferous, glauconitic, clayey, slightly sandy.
1	123	Limestone, white, very glauconitic, fossiliferous, pyritic, soft.
16	139	Marl, gray, very glauconitic, very fossiliferous slightly sandy with thin beds of limestone, white, fossiliferous, glauconitic, soft.
2	141	Limestone, gray, glauconitic, fossiliferous, pyritic.
		Vicksburg group (Mint Spring marl)
3	144	Sand, fine- to medium-grained, very limy, very fossiliferous, glauconitic.
6	150	Marl, gray-green, very clayey, fossiliferous, glauconitic.
6	156	Marl, gray-green, very sandy, fossiliferous, glauconitic.
		Forest Hill formation
8	164	Clay, brown, carbonaceous, silty.
12	176	Clay, gray-brown, carbonaceous, silty and sandy, tan, very fine-grained, argillaceous.
17	193	Clay, gray to brown, carbonaceous, micaceous, silty and sandy in part.
8	201	Sand, gray, very fine- to fine-grained, silty, micaceous.
33	234	Clay, gray, silty, micaceous, carbonaceous, lignitic in part, sandy in part.
		Yazoo formation
26	260	Clay, gray-green, silty in upper few feet, calcareous in lower part.

Hole AF-2

Location: 25 feet from west bank of Pearl River just north of cable bridge in NW.1/4, NW.1/4, Sec.19, T.4N., R.1E.

Elevation: 250 feet (hand level) Date: November 26, 1963

Purpose: AF-2 drilled and cored as a stratigraphic test at the type locality of the Byram marl and to obtain material for chemical analysis and paleontologic study. Descriptions from cores 0-76 feet; from cuttings 76-90 feet. Electrical log to total depth.

Thickness	Depth	Description
		Alluvium
17	17	Sand, white, fine-grained; clay, tan, silty.
		Vicksburg group (Byram marl)
13	30	Marl, gray, glauconitic, fossiliferous, clayey, iron stained in part, very slightly sandy in lower part.
		Vicksburg group (Glendon limestone)
1	31	Limestone, gray, fossiliferous, glauconitic, soft.
2	33	Marl, gray, glauconitic, clayey, fossiliferous.
3	36	Limestone, glauconitic, argillaceous, fairly hard.
12	48	Marl, gray, glauconitic, fossiliferous, argillaceous, soft limestone in part.
1	49	Marl, green, very glauconitic, fossiliferous, sandy.
5	54	Marl, gray-green, glauconitic, fossiliferous, slightly sandy.

		Vicksburg group (Mint Spring marl)
7	61	Marl, green, sandy, glauconitic, fossiliferous, pyritic, black phosphatic shells.
6	67	Marl, gray, clayey, glauconitic, fossiliferous, slightly sandy.
7	74	Marl, gray, clayey, sandy, glauconitic, fossiliferous.
		Forest Hill formation
2	76	Clay, gray-brown, silty, carbonaceous with some glauconite and fossil fragments.
14	90	Clay, gray, silty, carbonaceous.

Hole AF-3

Location: On median between U. S. Highway 80 and old Highway 80, (SW.1/4, NW.1/4, SE.1/4, Sec.23, T.6N., R.2W.)

Elevation: 348 feet (altimeter) Date: December 5, 1963

Purpose: Drilled to 300 feet for stratigraphic information. Electrical log to 218 feet where hole bridged. Description from cuttings.

Thickness	Depth	Description
		Catahoula formation
7	7	Sandstone, white, fine-grained, kaolinitic interstitial material.
5	12	Clay, gray, sandy, silty.
5	17	Siltstone, gray, clayey.
17	34	Clay, white to brown, very silty, sandy in part.
8	42	Sandstone, gray, fine-grained, very argillaceous.
6	48	Clay, pale-green, sandy in part.
4	52	Sand, gray, fine-grained.
14	66	Clay, green, blocky, waxy in part.
		Vicksburg group (Bucatunna clay)
10	76	Marl, gray-green, clayey, fossiliferous, glauconitic.
6	82	Clay, gray, fossiliferous, slightly glauconitic.
		Vicksburg group (Byram marl)
10	92	Marl, gray, very fossiliferous, glauconitic, clayey.
12	104	Clay, gray, very glauconitic, fossiliferous, marl in part.
		Vicksburg group (Glendon limestone)
2	106	Limestone, gray, glauconitic in part, fossiliferous.
26	132	Marl, gray, glauconitic, fossiliferous, clayey to slightly sandy; with thin beds of limestone, gray, glauconitic, fossiliferous soft to fairly hard.
		Vicksburg group (Mint Spring marl)
8	140	Marl, gray-green, very sandy, glauconitic, fossiliferous.
3	143	Marl, gray, clayey, glauconitic, fossiliferous.
11	154	Marl, gray, very fossiliferous, sandy, glauconitic.
		Forest Hill formation
19	173	Clay, gray, finely micaceous, carbonaceous, silty.
67	240	Clay, gray, silty, carbonaceous with some sand, gray, very fine- to fine-grained.
40	280	Clay and sand as above, very poor samples.
		Yazoo formation
20	300	Clay, gray to gray-green, calcareous, fossiliferous.

Hole AF-4

Location: 50 feet south of center line of U. S. Highway 80, (NE.1/4, SW.1/4, Sec.23, T.6N., R.2W.)

Elevation: 312 feet (hand level) Date: December 6, 1963

Purpose: To obtain clay for testing. Cored to 32.5 feet. No electrical log.

Thickness	Depth	Description
1	1	Soil, tan silt.
		Catahoula formation
15	16	Clay, purple to gray, very sandy and silty in part.
4	20	Sand, yellow, fine- to medium-grained, with blebs of clay, tan, tough, blocky.
3	23	Clay, tan, blocky, tough, limonite staining along fractures.
7.5	30.5	Clay, green, blocky, tough.
2	32.5	Clay, gray, slightly silty.

Hole AF-5

Location: In road juncture between State Highway 18 and gravel road in SE.1/4, SW.1/4, NE.1/4, Sec.11, T.4N., R.3W.

Elevation: 252 feet (altimeter) Date: December 10, 1963

Purpose: Drilled to 323 feet for stratigraphic information. Descriptions from cuttings. Electrical log to total depth.

Thickness	Depth	Description
		Colluvium
13	13	Sand, yellow and red, stained with iron, fine- to coarse-grained; clay, yellow, red, sandy.
		Catahoula formation
91	104	Clay, gray and light-gray, silty, pyritic in part, siltstone in part.
14	118	Clay, green, blocky, tough.
		Vicksburg group (Bucatunna clay)
18	136	Clay, dark gray to black, silty in part.
2	138	Sand, gray, fine-grained, slightly glauconitic.
29	167	Clay, dark-gray to black, silty in part, slightly glauconitic and fossiliferous in lower part.
		Vicksburg group (Byram marl)
22	189	Marl, gray-green, glauconitic, clayey, fossiliferous, limy clay in part.
		Vicksburg group (Glendon limestone)
3	192	Limestone, gray, glauconitic, fossiliferous, soft to fairly hard.
30	222	Marl, gray, fossiliferous, glauconitic, clayey to slightly sandy in lower part; with thin beds of limestone, gray, fossiliferous, glauconitic, soft, chalky in appearance.
		Vicksburg group (Mint Spring marl)
20	242	Marl and limy sand, gray-green, very fossiliferous, glauconitic, clayey in middle portion.
		Forest Hill formation
54	296	Clay, gray, carbonaceous, silty, micaceous, sandy in part.
20	316	Sand, gray, fine-grained, very silty and argillaceous.
		Yazoo formation
7	323	Clay, gray, slightly calcareous.

Hole AF-6

Location: Just south of field road which connects two farm-to-market roads in NW.1/4, SW.1/4, NE.1/4, Sec.25, T.6N., R.3W.

Elevation: 210 feet (hand level) Date: December 11, 1963

Purpose: Drilled to 230 feet for stratigraphic information. Descriptions from cuttings. Electrical log to total depth.

Thickness	Depth	Description
		Alluvium
19	19	Silt, yellow, sandy in part.
7	26	Sand, fine- to very coarse-grained, with quartz pebbles and chert fragments.
		Vicksburg group (Byram marl)
10	36	Marl, gray, glauconitic, fossiliferous, clayey, slightly sandy.
		Vicksburg group (Glendon limestone)
3	39	Limestone, gray, glauconitic, fossiliferous, soft.
26	65	Marl, gray-green, glauconitic, sandy; some beds of limestone, gray, glauconitic, fossiliferous, soft to fairly hard.
		Vicksburg group (Mint Spring marl)
31	96	Sand, gray, fine- to coarse-grained, very fossiliferous, very glauconitic, clayey in middle portion.
		Forest Hill formation
26	122	Clay, gray, carbonaceous, micaceous, silty.
78	200	Clay, gray, carbonaceous, micaceous, silty; sand, gray, fine-grained, silty, micaceous, carbonaceous.
		Yazoo formation
30	230	Clay, gray, calcareous, rare fossils (foraminifera).

Hole AF-7

Location: On south side of gravel private road in SW.1/4, SW.1/4, NW.1/4, Sec.31, T.7N., R.2W.

Elevation: 285 feet (from topographic map) Date: December 12, 1963

Purpose: Drilled to 240 feet for stratigraphic information. Descriptions from cuttings. Electrical log to total depth.

Thickness	Depth	Description
		Loess
16	16	Silt, tan to yellow.
		Catahoula formation
14	30	Clay, tan to gray, sandy and silty in part.
11	41	Sand, gray, very fine-grained, clayey.
		Vicksburg group (Bucatunna clay)
19	60	Clay, gray to dark-gray, rare fossil fragments.
		Vicksburg group (Byram marl)
11	71	Marl, gray, fossiliferous, glauconitic, clayey.
		Vicksburg group (Glendon limestone)
2	73	Limestone, gray, glauconitic, slightly fossiliferous, soft.
35	108	Marl, gray, glauconitic, fossiliferous, clayey to slightly sandy, soft limestone in thin beds.

		Vicksburg group (Mint Spring marl)
19	127	Marl, gray-green, glauconitic, very fossiliferous, very sandy with fine- to coarse-grained sand.
		Forest Hill formation
50	177	Clay, gray, carbonaceous, micaceous, silty, sandy.
29	206	Clay, gray, carbonaceous, silty.
		Yazoo formation
34	240	Clay, gray, slightly calcareous to calcareous.

Hole AF-8

Location: Just off south side of State Highway 18 at juncture with Forest Hill road in SE 1/4, SE 1/4, NE 1/4, Sec.22, T.5N., R.1W.

Elevation: 435 feet (hand level) Date: December 13, 1963

Purpose: Cored and drilled to 100 feet to sample the type locality of the Forest Hill formation. Description from cores 0-77 feet, cuttings 77-100 feet. Electrical log to total depth.

Thickness	Depth	Description
6	6	Soil and silt, tan.
		Vicksburg group (Glendon limestone and Mint Spring marl)
12	18	Clay, yellow, sandy, limy in part, slightly glauconitic, some limestone, badly weathered.
		Forest Hill formation
4	22	Clay, brown, slightly carbonaceous with sand-filled borings (?).
3	25	Sand, yellow and gray, fine-grained, micaceous, silty, stained with limonite in part.
4	29	Clay, gray, silty, micaceous, finely carbonaceous.
8	37	Sand, gray to yellow, fine-grained, silty and clayey in part.
.5	37.5	Lignite
28.5	66	Clay, gray, carbonaceous, micaceous, silty, very silty and sandy in part.
3	69	Sand, gray, fine-grained, very lignitic with a few thin beds of lignite, clayey in lower 1 foot.
		Yazoo formation
8	77	Clay, gray-green, slightly silty.
23	100	Clay, gray-green, calcareous.

Hole AF-9

Location: 20 feet off road at 90 degree turn in road in NW.1/4, NE.1/4, NE.1/4, Sec.25, T.3N., R.2W.

Elevation: 330 feet (from topographic map) Date: February 5, 1964

Purpose: Drilled to 490 feet for stratigraphic information. Descriptions from cuttings. Electrical log to total depth.

Thickness	Depth	Description
4	4	Soil, silt and fine sand.
		Catahoula formation
14	18	Clay, gray to tan, plastic, slightly silty.
26	44	Siltstone, gray, sandy in part, clayey in part.
15	59	Clay, green to dark-green, blocky, tough.
14	73	Siltstone, gray, clayey, sandy in part.

37	110	Clay, gray to purple, silty.
8	118	Siltstone, very hard in part.
66	184	Clay, gray, silty to very silty, siltstone in part, sandy in part.
86	270	Clay, gray to pale-green, silty in part.
34	304	Sand, gray, very fine- to fine-grained, argillaceous and silty in part.
		Vicksburg group (Bucatunna clay)
49	353	Clay, dark-gray, smooth.
		Vicksburg group (Byram marl)
19	372	Marl, gray, glauconitic, fossiliferous, clayey.
		Vicksburg group (Glendon limestone)
32	404	Limestone, gray, glauconitic, fossiliferous, soft; marl in part.
		Vicksburg group (Mint Spring marl)
12	416	Sand, gray, fine-grained, glauconitic, fossiliferous.
		Forest Hill formation
20	436	Clay, gray, micaceous, silty and sandy in part.
14	450	Sand, gray, fine-grained, silty.
24	474	Clay, gray, micaceous, silty, lignitic.
16	490	Sand, gray, fine-grained, silty.

Hole AF-10

Location: Just north of gravel road in NW. corner of NE.1/4, SW.1/4, SW.1/4, Sec.17, T.3N., R.3W.

Elevation: 395 feet (hand level) Date: February 12, 1964

Purpose: Drilled to 500 feet for stratigraphic information. Description from cuttings. Electrical log to 225 where hole bridged.

Thickness	Depth	Description
		Terrace deposit
15	15	Sand, yellow, fine- to coarse-grained, with chert pebbles and some silty, sandy clay.
		Catahoula formation
65	80	Clay, light gray to gray-green, silty to very silty, with thin beds of sandstone, gray, fine-grained, argillaceous.
11	91	Sandstone, gray, fine- to medium-grained, argillaceous.
29	120	Siltstone, light-gray; very fine-grained sandstone in part; clay, gray, very silty.
105	225	Clay, light-gray to tan, silty, sandy in part, pyritic.
35	260	Sand, gray, fine-grained, kaolinitic, silty, finely carbonaceous in part.
20	280	Clay, gray, sandy, silty, carbonaceous.
70	350	Clay, light-gray, very silty, sandy; siltstone, gray; sandstone, gray, fine-grained, silty, pyritic.
10	360	Sandstone, gray, fine- to coarse-grained, soft, pyritic.
60	420	Clay, gray to white, silty, siltstone in part.
35	455	Sand, gray, fine- to medium-grained, loose.
15	470	Clay, gray, plastic.
		Vicksburg group (Bucatunna clay)
20	490	Clay, dark-gray, some fossils.
10	500	Marl, green, clayey, glauconitic, fossiliferous.

Hole AF-11

Location: In pasture in NE.1/4, SW.1/4, NW.1/4, Sec.20, T.3N., R.2W.

Elevation: 355 feet (from topographic map) Date: February 18, 1964

Purpose: Drilled to 400 feet for stratigraphic information. Description from cuttings. Electrical log to total depth.

Thickness	Depth	Description
		Loess
6	6	Silt, tan to brown.
		Catahoula formation
18	24	Clay, tan, sandy and silty in part.
8	32	Sand, gray, fine-grained, very silty.
17	49	Clay, tan, silty in part.
13	62	Sand, white, fine-grained, much kaolinitic interstitial material.
20	82	Clay, tan, mottled with red, smooth.
24	106	Sand, fine- to coarse-grained, kaolinitic.
92	198	Clay, light-gray to tan, very silty, siltstone in part; thin beds of fine-grained sandstone.
32	230	Sand, white, fine-grained, pyritic, kaolinitic.
84	314	Clay, light-gray to tan, silty, sandy; and siltstone, light-gray, clayey.
10	324	Sand, gray, fine-grained.
		Vicksburg group (Bucatunna clay)
42	366	Clay, dark-gray, finely carbonaceous, glauconitic in part.
		Vicksburg group (Byram marl)
17	383	Marl, green to light-brown, very clayey, glauconitic, fossiliferous.
		Vicksburg group (Glendon limestone)
2	385	Limestone, gray, glauconitic, fossiliferous, argillaceous.
15	400	Marl, green, glauconitic, fossiliferous, clayey; with beds of limestone, gray, glauconitic, fossiliferous, soft.

Hole AF-12

Location: 100 feet NE. of center line of State Highway 3, 2100 feet E. of W.line and 50 feet S. of N.line of Sec.8, T.13N., R.5E., Claiborne County, Mississippi.

Elevation: 160 feet (from topographic map) Date: February 20, 1964

Purpose: Drilled to 410 feet for stratigraphic information. Description from cuttings. Electrical log to total depth.

Thickness	Depth	Description
		Alluvium
11	11	Gravel, chert fragments, quartz pebbles, very coarse-grained sand.
		Catahoula formation
4	15	Clay, tan, silty.
5	20	Sandstone, white, fine-grained, kaolinitic.
38	58	Clay, light-gray to tan, silty; siltstone in part.
17	75	Sand, gray, fine-grained, argillaceous.
44	119	Clay, light-gray to pale-green, silty, sandy in part.
23	142	Sand, gray, fine- to coarse-grained, clayey, pyritic.
36	178	Clay, tan, smooth to slightly silty.
78	256	Clay, tan to light-gray, silty; siltstone in part.
8	264	Sand, gray, fine-grained, silty, argillaceous.

		Vicksburg group (Bucatunna clay)
29	293	Clay, gray, smooth.
5	298	Marl, gray, clayey, glauconitic, fossiliferous.
10	308	Clay, dark-gray, smooth.
		Vicksburg group (Byram marl)
16	324	Marl, gray-green, glauconitic, fossiliferous, clayey; limy clay in part.
		Vicksburg group (Glendon limestone)
2	326	Limestone, gray, glauconitic, fossiliferous, soft.
8	334	Clay, gray-green, limy, fossiliferous, glauconitic.
41	375	Marl, gray, glauconitic, fossiliferous, slightly sandy; soft limestone beds.
		Vicksburg group (Mint Spring marl)
11	386	Marl, gray, green, sandy, glauconitic, fossiliferous, clayey in lower part.
11	397	Sand, gray, fine- to coarse-grained, glauconitic, very fossiliferous.
		Forest Hill formation
13	410	Clay, gray, silty, finely micaceous.

Hole AF-13

Location: Off northeast side of State Highway 27, 50 feet northwest of juncture with southeast trending gravel road in NE.1/4, SE.1/4, SE.1/4, Sec.1, T.14N., R.5E.

Elevation: 215 feet (from topographic map) Date: February 26, 1964

Purpose: Drilled to 280 feet for stratigraphic information. Descriptions from cuttings. Electrical log to total depth.

Thickness	Depth	Description
		Loess
11	11	Silt, yellow, some small limonite concretions.
		Catahoula formation
20	31	Clay, tan, very silty, very sandy in part; siltstone in part.
53	84	Clay, tan, white and pale-green, very silty; siltstone in part, sandy.
10	94	Sandstone, white, fine-grained, finely micaceous, argillaceous.
11	105	Clay, brown, sandy.
15	120	Sand, brown, fine-grained, very argillaceous in part.
10	130	Clay, light-gray, silty, sandy.
8	138	Sand, tan, fine-grained, argillaceous.
		Vicksburg group (Bucatunna clay)
42	180	Clay, dark-gray, very finely micaceous.
		Vicksburg group (Byram marl)
22	202	Marl, gray-green, clayey, fossiliferous, very glauconitic, possibly sideritic in part.
		Vicksburg group (Glendon limestone)
3	205	Limestone, gray, fossiliferous, glauconitic, fairly soft.
7	212	Clay, gray-green, very limy, glauconitic, fossiliferous.
14	226	Marl, green, glauconitic, fossiliferous, clayey; soft limestone in part.
4	230	Limestone, gray, fossiliferous, glauconitic, argillaceous, fairly soft.
9	239	Marl, green, glauconitic, fossiliferous, sandy, clayey.
10	249	Marl, gray-green, sandy, glauconitic, fossiliferous; soft limestone in part.

		Vicksburg group (Mint Spring marl)
25	274	Sand, gray, fine- to coarse-grained, very glauconitic, very fossiliferous; coarser at base.
		Forest Hill formation
6	280	Clay, brown, silty.

Hole AF-14

Location: 20 feet off west side of asphalt road in SE.1/4, NW.1/4, NW.1/4, Sec.35, T.14N., R.5E.

Elevation: 310 feet (from topographic map) Date: February 26, 1964

Purpose: Cored to 28 feet to obtain gravel samples for analysis. Descriptions from cores. Electrical log to total depth.

Thickness	Depth	Description
		Loess
8.5	8.5	Silt, brown.
		Terrace deposit
4.5	13	Sand, red, fine- to coarse-grained; with chert gravel, some quartz gravel, clayey.
12	25	Sand, yellow, fine- to coarse-grained, stained with iron.
		Catahoula formation
3	28	Clay, gray, plastic, slightly silty in part.

Hole AF-15

Location: At side of outbuilding in front of home on south side of east-west asphalt road just east of juncture with gravelled trail in NE.1/4, SW.1/4, Sec.36, T.14N., R.5E.

Elevation: 320 feet (from topographic map) Date: February 26, 1964

Purpose: Cored to 32 feet to obtain gravel samples for analysis. Descriptions from cores. No electrical log.

Thickness	Depth	Description
		Loess
7.5	7.5	Silt, brown.
		Terrace deposit
2.0	9.5	Sand, red, coarse-grained; with chert gravel, minor quartz gravel.
22.5	32	Sand, red to yellow, medium- to coarse-grained, stained with iron in part.

Hole AF-16

Location: In front of abandoned house on west side of north-south gravel road in SW.1/4, SW.1/4, SW.1/4, Sec.16, T.13N., R.5E.

Elevation: 310 feet (from topographic map) Date: February 27, 1964

Purpose: Cored to 22 feet to obtain gravel samples for analysis. Descriptions from cores. No electrical log.

Thickness	Depth	Description
		Loess
6	6	Silt, tan to brown.
		Terrace deposit
16	22	Sand, red, medium- to very coarse-grained, with chert gravel, rare quartz gravel. Some gravel 4" in diameter.

Hole AF-17

Location: In Riverside Park, City of Jackson; 400 feet south of gulch exposing Yazoo clay, Moodys Branch marl and Cockfield clays; 800 feet from west line and 750 feet from north line of Sec.36, T.6N., R.1E.

Elevation: 340 feet (from topographic map) Date: March 7, 1964

Purpose: Drilled and cored as a stratigraphic test at the alternate type locality of the Moodys Branch marl. Descriptions from cores 0-69 feet, from cuttings 70-430 feet. Electrical log to total depth.

Thickness	Depth	Description
6	6	Soil, silt and sand.
		Terrace deposit
3	9	Sand, yellow, fine- to medium-grained, stained with iron.
		Yazoo formation
1	10	Clay, light-green to yellow, mottled, with limonite streaks and black streaks of manganiferous material.
3.5	13.5	Clay, light-green, manganiferous streaks.
5	18.5	Clay, tan to pale-green, calcareous, gypsiferous, very fossiliferous.
2.5	21	Clay, tan mottled with blue-gray, calcareous, fossiliferous.
13	34	Clay, gray to gray-green, calcareous, fossiliferous, some pyrite.
4.5	38.5	Clay, blue-gray, calcareous, fossiliferous, some pyrite.
2.5	41	Clay, light-green, very limy, very fossiliferous, glauconitic.
3	44	Clay, light-green, very limy, very fossiliferous, glauconitic, sandy.
		Moodys Branch formation
13	57	Sand, green, fine-grained, very fossiliferous, very glauconitic, very limy, clayey in upper part.
		Cockfield formation
7	64	Clay, gray, slightly carbonaceous, with thin layers and borings with glauconitic, fossiliferous sand.
5	69	Sand, gray, fine-grained, silty, micaceous, carbonaceous.
4	73	Clay, gray, very silty, carbonaceous, sandy.
1	74	Lignite, brown to black, sandy in part.
16	90	Clay, gray, very silty, carbonaceous.
10	100	Sand, gray, fine-grained, micaceous, carbonaceous, argillaceous and silty in part.
20	120	Sand, gray, fine-grained, micaceous, carbonaceous, very silty; silt, gray, micaceous, carbonaceous, sandy.
14	134	Clay, gray-brown, silty, micaceous, carbonaceous.
80	214	Clay, gray, silty, micaceous, carbonaceous and sand, gray, fine-grained, silty, argillaceous, micaceous, carbonaceous.
92	306	Sand, gray, very fine- to fine-grained, micaceous, silty and argillaceous in part, some sideritic material in part.
		Cook Mountain formation
72	378	Clay, gray-brown, micaceous, carbonaceous in part.
10	388	Marl, light-gray, glauconitic, sandy, fossiliferous (foraminifera)
17	405	Clay, gray-brown, micaceous.
4	409	Marl, gray, glauconitic, sandy, fossiliferous.
8	417	Clay, gray-brown, micaceous.
3	420	Marl, gray, glauconitic, sandy, fossiliferous.
10	430	Clay, gray-brown, micaceous.

Hole AF-18

Location: 62 feet south of the center line of south lane of Interstate Highway 55 in SE.1/4, NE.1/4, Sec.16, T.5N., R.1E.

Elevation: 278 feet (hand level) Date: March 11, 1964

Purpose: Drilled to 480 feet for stratigraphic information. Description from cuttings. Electrical log to total depth.

Thickness	Depth	Description
2	2	Soil
		Yazoo formation
14	16	Clay, yellow to light-gray, rare foraminifera.
56	72	Clay, gray-green, calcareous, fossiliferous.
10	82	Clay, gray, glauconitic, very limy, very fossiliferous, slightly sandy in lower part.
		Moodys Branch formation
6	88	Sand, gray, fine-grained, clayey, very limy, glauconitic, fossiliferous.
		Cockfield formation
12	100	Clay, dark-gray, micaceous.
10	110	Sand, gray, very fine- to fine-grained.
12	122	Clay, gray, silty, sandy, carbonaceous.
27	149	Sand, gray, fine- to medium-grained, silty and argillaceous in part.
11	160	Clay, gray, silty, micaceous, carbonaceous.
94	254	Sand, gray, very fine- to fine-grained, silty, argillaceous; clay, gray, silty, micaceous, carbonaceous.
11	265	Clay, gray, silty, sandy, micaceous, carbonaceous.
55	320	Sand, gray, very fine- to fine-grained, silty and argillaceous in part.
		Cook Mountain formation
89	409	Clay, dark-gray to gray, finely micaceous, silty in part.
8	417	Marl, light-gray, very fossiliferous, glauconitic, sandy, soft limestone in part.
25	442	Clay, gray, micaceous, carbonaceous, silty.
4	446	Marl, light-gray, silty, glauconitic, fossiliferous.
11	457	Clay, gray, finely micaceous, carbonaceous, shale in part.
3	460	Marl, light-gray, glauconitic, fossiliferous.
20	480	Shale, gray, finely micaceous, carbonaceous.

Hole AF-19

Location: On highway right-of-way on west side of frontage road of Interstate Highway 55, south of Elton road in SW.1/4, SE.1/4, NE.1/4, Sec.6, T.4N., R.1E.

Elevation: 333 feet (altimeter) Date: March 14, 1964

Purpose: Drilled to 500 feet for stratigraphic information. Descriptions from cuttings. Electrical log to total depth.

Thickness	Depth	Description
3	3	Soil
		Forest Hill formation
3	6	Sand, yellow, fine-grained.
5	11	Clay, tan, silty, sandy, limonite stained in part.
14	25	Sand, white, very fine- to medium-grained, silty and argillaceous in part.

8	33	Clay, gray, silty, carbonaceous, micaceous.
7	40	Sand, white, fine-grained.
6	46	Clay, gray, silty, slightly carbonaceous.
		Yazoo formation
74	120	Clay, gray-green, calcareous, slightly fossiliferous (foraminifera).
10	130	Clay, gray, slightly calcareous.
134	264	Clay, gray-green, calcareous, fossiliferous.
7	271	Clay, gray, very limy.
82	353	Clay, gray-green, calcareous, fossiliferous.
12	365	Clay, gray, very limy.
98	463	Clay, gray-green, calcareous, fossiliferous.
11	474	Clay, gray, very limy, glauconitic, slightly sandy.
		Moodys Branch formation
6	480	Sand, gray-green, fine- to medium-grained, glauconitic, calcareous, fossiliferous.
		Cockfield formation
8	488	Clay, gray, silty, micaceous, sideritic in part.
3	491	Sand, gray, fine-grained, silty.
9	500	Clay, gray, silty, micaceous.

Hole AF-20

Location: 60 feet northwest of center line of Old Canton Road, 2280 feet north of south line and 350 feet east of west line of Sec.8, T.6N., R.2E.

Elevation: 295 feet (from topographic map) Date: March 19, 1964

Purpose: Drilled to 260 feet for stratigraphic information. Description from cuttings. Electrical log to total depth.

Thickness	Depth	Description
		Alluvium
12	12	Silt, tan, mottled with yellow, clayey in part.
4	16	Sand, fine- to very coarse-grained, with quartz and chert gravel.
		Yazoo formation
5	21	Clay, gray, mottled with yellow.
71	92	Clay, gray-green, calcareous, fossiliferous, gypsiferous in upper part.
42	134	Clay, gray-green, calcareous, fossiliferous, pyritic in part.
33	167	Clay, gray-green, calcareous, fossiliferous.
15	182	Clay, gray, very limy, glauconitic, very fossiliferous, sandy in lower part.
		Moodys Branch formation
12	194	Sand, gray-green, fine- to coarse-grained, very fossiliferous, very glauconitic, calcareous, clayey in part.
		Cockfield formation
6	200	Clay, gray, silty, micaceous.
6	206	Sand, gray, fine-grained.
10	216	Clay, gray, silty, carbonaceous, micaceous.
12	228	Sand, gray, fine- to medium-grained, silty, micaceous.
6	234	Clay, gray, silty, lignitic.
14	248	Sand, gray, fine-grained, silty.
12	260	Clay, gray, silty, carbonaceous, micaceous.

Hole AF-21

Location: 100 feet north of levee for boat marina of Ross Barnett Reservoir in NE.1/4, SW.1/4, NW.1/4, Sec.27, T.7N., R.2E., Madison County, Mississippi.

Elevation: 304 feet (from topographic map) Date: March 24, 1964

Purpose: Drilled to 400 feet for stratigraphic information. Descriptions from cuttings. Electrical log to total depth.

Thickness	Depth	Description
		Alluvium
12	12	Sand, gray, mottled with yellow, fine- to coarse-grained, clayey.
		Yazoo formation
20	32	Clay, gray, mottled with yellow, slightly calcareous in lower part.
33	65	Clay, gray-green, calcareous, fossiliferous.
57	122	Clay, gray-green, calcareous, fossiliferous, rare mica in upper part.
183	305	Clay, gray-green, calcareous, fossiliferous, some pyrite.
17	322	Clay, gray, very limy, glauconitic.
		Moodys Branch formation
33	355	Sand, gray-green, fine-grained, very glauconitic, fossiliferous, calcareous.
		Cockfield formation
28	383	Clay, brown, micaceous, silty, slightly carbonaceous, lignitic in part.
4	387	Sand, gray, fine-grained, silty.
13	400	Clay, gray, silty, sandy, micaceous, lignitic.

Hole AF-22

Location: NE.1/4, SE.1/4, NE.1/4, Sec.12, T.7N., R.2E., Madison County, Mississippi.

Elevation: 340 feet (from topographic map) Date: March 25, 1964

Purpose: Drilled to 340 feet for stratigraphic information. Description from cuttings. Electrical log to total depth.

Thickness	Depth	Description
		Alluvium
15	15	Sand, yellow, fine- to coarse-grained, stained with limonite, very clayey.
12	27	Sand, white, fine- to coarse-grained with quartz gravel, rare chert.
		Yazoo formation
67	94	Clay, gray to gray-green, calcareous, fossiliferous.
41	135	Clay, gray-green, calcareous, fossiliferous, rare mica.
25	160	Clay, gray-green, calcareous, fossiliferous, slightly silty.
113	273	Clay, gray-green, calcareous, fossiliferous.
10	283	Clay, gray, limy, very fossiliferous, glauconitic.
		Moodys Branch formation
35	318	Sand, gray, fine- to coarse-grained, very fossiliferous, glauconitic, limy.
		Cockfield formation
7	325	Clay, brown, silty, carbonaceous.
6	331	Sand, fine-grained, silty, micaceous.
9	340	Clay, brown, silty, sandy, carbonaceous.

Hole AF-23

Location: In southeastern portion of District 1 Supervisor's lot, 950 feet from west line and 80 feet from south line of Sec.16, T.6N., R.1E.

Elevation: 335 feet (hand level) Date: June 9, 1964

Purpose: Drilled to 500 feet for stratigraphic information. Descriptions from cuttings. Electrical log to total depth.

Thickness	Depth	Description
4	4	Soil, sandy, silty.
		Yazoo formation
16	20	Clay, yellow, gray and mottled, slightly calcareous.
30	50	Clay, gray-green, calcareous, fossiliferous, gypsiferous.
104	154	Clay, gray-green, calcareous, fossiliferous.
10	164	Clay, gray, very limy, very fossiliferous, glauconitic.
		Moodys Branch formation
14	178	Marl, gray-green, glauconitic, very fossiliferous, very sandy.
		Cockfield formation
4	182	Clay, brown, silty, slightly carbonaceous, micaceous.
76	258	Clay, gray-brown, silty, very sandy, micaceous; argillaceous sand in part.
12	270	Sand, gray, fine-grained, silty.
50	320	Clay, gray, very silty, sandy, micaceous, sideritic in lower part.
10	330	Sand, gray, fine-grained, micaceous.
61	391	Clay, brown, silty, micaceous, carbonaceous, sandy in part.
45	436	Sand, gray, fine-grained, silty, argillaceous in part.
		Cook Mountain formation
64	500	Clay, gray, finely carbonaceous.

Hole AF-24

Location: 40 feet northeast of center line of old Highway 49 in SE.1/4, NE.1/4, SE.1/4, Sec.2, T.6N., R.1W.

Elevation: 285 feet (from topographic map) Date: June 10, 1964

Purpose: Drilled to 500 feet for stratigraphic information. Description from cuttings. Electrical log to total depth.

Thickness	Depth	Description
4	4	Soil, brown, sandy, silty.
		Yazoo formation
26	30	Clay, light-gray to yellow, slightly calcareous.
18	48	Clay, gray-green, calcareous, fossiliferous, gypsiferous.
32	80	Clay, gray-green, calcareous, fossiliferous.
7	87	Clay, gray, calcareous, silty.
105	192	Clay, gray-green, fossiliferous, calcareous.
16	208	Clay, gray, limy, fossiliferous, glauconitic.
		Moodys Branch formation
15	223	Marl, gray-green, glauconitic, fossiliferous, very sandy; limy sand in part.
		Cockfield formation
17	240	Sand, gray, fine-grained, argillaceous, silty.
36	276	Clay, gray, finely micaceous, silty, carbonaceous.
19	295	Sand, gray, fine-grained, clayey, silty.
90	385	Clay, gray, silty, micaceous, very sandy in part; argillaceous sand in part.

15	400	Sand, gray, very fine- to fine-grained, silty.
7	407	Clay, gray, silty, micaceous.
11	418	Sand, gray, fine-grained, silty, argillaceous.
59	477	Clay, gray, silty, micaceous.
23	500	Sand, gray, very fine- to fine-grained, silty, micaceous.

Hole AF-25

Location: 50 feet west of center of north-south asphalt road in SE.1/4, SE.1/4, NW.1/4, Sec.31, T.7N., R.1W.

Elevation: 400 feet (from topographic map) Date: June 12, 1964

Purpose: Drilled to 500 feet for stratigraphic information. Description from cuttings. Electrical log to total depth.

Thickness	Depth	Description
		Loess
3	3	Silt, yellow.
		Terrace deposit
35	38	Sand, white, stained with yellow in part, fine- to very coarse-grained.
36	74	Sand, white, fine- to coarse-grained, few chert grains and heavy mineral grains.
13	87	Sand, white, fine- to coarse-grained; clay, red, yellow, buff, sandy.
		Forest Hill formation
12	99	Clay, dark-gray, carbonaceous.
5	104	Sand, gray, fine-grained.
20	124	Clay, dark-gray, carbonaceous, micaceous.
3	127	Sand, gray, fine- to medium-grained.
8	135	Clay, gray, micaceous, silty; silt, gray, finely micaceous.
4	139	Sand, gray, very fine-grained, silty.
10	149	Silt, gray, micaceous, clayey.
5	154	Sand, gray, fine-grained, silty.
8	162	Clay, dark-gray, carbonaceous.
3	165	Sand, gray, fine-grained, silty.
		Yazoo formation
10	175	Clay, gray to pale-green, non-calcareous.
43	218	Clay, gray, calcareous, sparingly fossiliferous (foraminifera).
56	274	Clay, gray-green, calcareous, fossiliferous, macro- and micro-fossils.
10	284	Clay, gray, slightly silty.
56	340	Clay, gray-green, calcareous, sparingly fossiliferous.
160	500	Clay, gray-green, calcareous, fossiliferous.

Hole AF-26

Location: Just northwest of juncture of north lane of Interstate Highway 20 and gravel road to Norrell in approximate center of NW.1/4, Sec.22, T.6N., R.2W.

Elevation: 290 feet (from topographic map) Date: July 29, 1964

Purpose: Cored to 32 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
		Loess
8	8	Silt, tan.

		Vicksburg group (Bucatunna clay)
13	21	Clay, tan, plastic to blocky, limonitic staining on fractures and partings.
3	24	Clay, tan, silty and sandy.
8	32	Sand, yellow, very clayey, calcareous, fossiliferous.

Hole AF-27

Location: 50 feet northwest of juncture of State Highway 27 and asphalt road running north, approximately 500 feet north of the center of Sec.36, T.3N., R.3W.

Elevation: 290 feet (hand level) Date: August 4, 1964

Purpose: Cored to 22 feet to obtain clay samples for testing. Description from cores. No electrical log.

Thickness	Depth	Description
		Catahoula formation
20	20	Clay, tan to light-gray, silty.
2	22	Siltstone, light-gray, clayey, sandy.

Hole AF-28

Location: 110 feet south of center line of northeast-southwest trending asphalt road in NW.1/4, SW.1/4,SW.1/4, Sec.14, T.3N., R.3W.

Elevation: 360 feet (from topographic map) Date: August 4, 1964

Purpose: Cored to 32 feet to obtain clay samples for testing. Description from cores. No electrical log.

Thickness	Depth	Description
2	2	Soil, brown, silt.
		Catahoula formation
4	6	Clay, gray, silty, thin streak of kaolinitic siltstone at 6 feet.
10	16	Clay, gray to tan, silty, with limonite stained fractures.
6	22	Clay, gray to tan, silty.
5	27	Clay, tan, silty, black partings, probably manganiferous material.
5	32	Siltstone, tan, clayey, sandy.

Hole AF-29

Location: In middle of trail through woods approximately 250 feet northeast of AF-10 in SW.1/4, NW.1/4, SW.1/4, Sec.17, T.3N., R.3W.

Elevation: 390 feet (from topographic map) Date: August 5, 1964

Purpose: Cored to 34 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
		Loess
6	6	Silt, tan.
		Catahoula formation
4	10	Clay, gray, very silty.
6	16	Clay, gray, slightly silty.
1	17	Sand, gray, very fine- to fine-grained, silty.
12	29	Clay, gray, plastic, slightly silty.
5	34	Sand, gray, fine-grained, slightly kaolinitic.

Hole AF-30

Location: 50 feet west of center of asphalt road in SW.1/4, SE.1/4, NE.1/4, Sec.2., T.13N., R.5E.

Elevation: 310 feet (from topographic map) Date: August 5, 1964

Purpose: Cored to 38 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
		Terrace deposit
1	1	Gravel, mostly chert gravel, much pink clay.
		Catahoula formation
4	5	Clay, gray, plastic, slightly silty.
5	10	Clay, gray, very silty in part.
7	17	Clay, gray, very silty; clayey silt in part.
15	32	Clay, pale-green, plastic to silty in part.
4	36	Clay, brown, carbonaceous.
2	38	Sand, green, fine-grained, silty, clayey.

Hole AF-31

Location: On edge of gravel road at south end of gravel pit in SE.1/4, NE.1/4, SE.1/4, Sec.23, T.4N., R.4W.

Elevation: 360 feet (from topographic map) Date: August 6, 1964

Purpose: Cored to 22 feet to obtain clay samples for testing. Description from cores. No electrical log.

Thickness	Depth	Description
		Terrace deposit
2	2	Sand, red, very coarse-grained, much chert gravel, minor quartz gravel.
4	6	Clay, gray and red mottled, plastic, tough, silty.
14	20	Clay, pink, gray and red mottled, with thin laminae of sand, fine- to medium-grained.
2	22	Sand, light-gray, silty, clayey.

Hole AF-32

Location: In pasture 100 feet south of gravel road in approximate center Sec.16, T.4N., R.2W.

Elevation: 325 feet (from topographic map) Date: August 6, 1964

Purpose: Cored to 32 feet to obtain clay samples for testing. Description from cores. No electrical log.

Thickness	Depth	Description
		Loess
5	5	Silt, tan.
		Catahoula formation
7	12	Sand, light-gray, fine-grained, argillaceous.
4	16	Clay, gray, plastic, silty in part.
4	20	Clay, gray, silty, sandy.
2	22	Sand, gray, fine-grained, silty, hard.
8	30	Clay, green, blocky, silty.
2	32	Silt, green, clayey, sandy.

Hole AF-33

Location: In pasture 100 feet east of gravel road in NE.1/4, SE.1/4, SW.1/4, Sec.16, T.3N., R.2W.

Elevation: 360 feet (from topographic map) Date: August 7, 1964

Purpose: Cored to 32 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
		Loess and soil
4	4	Silt, tan to brown.
		Catahoula formation
4	8	Sand, gray to yellow, fine-grained, silty.
10	18	Clay, gray, slightly silty.
1	19	Sand, gray, fine-grained, silty.
4	23	Clay, gray, very silty in part.
4	27	Sand, gray, fine-grained, silty, sandstone in part.
3	30	Clay, gray, plastic, slightly silty.
2	32	Sandstone, white, fine-grained, kaolinitic interstitial material, silty.

Hole AF-34

Location: 5 feet north of AF-9 in NW.1/4, NE.1/4, NE.1/4, Sec.25, T.3N., R.2W.

Elevation: 330 feet (from topographic map) Date: August 7, 1964

Purpose: Cored to 28.5 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
4	4	Soil, silt and fine sand.
		Catahoula formation
14	18	Clay, gray-brown, plastic to very silty.
1	19	Sand, gray, fine-grained, silty.
7	26	Clay, gray-brown, silty.
2.5	28.5	Sand, green, fine-grained, silty, clayey.

Hole AF-35

Location: 150 feet east of blacktop road on old sawmill lot in approximate center NE.1/4, NE.1/4, Sec.27, T.3N., R.1W.

Elevation: 315 feet (from topographic map) Date: August 11, 1964

Purpose: Cored to 30 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
2	2	Soil, silt, brown.
		Catahoula formation
10	12	Clay, gray, plastic in part, very silty in part.
10	22	Sand, light-gray, fine-grained, silty, sandstone in part.
8	30	Clay, green, blocky, silty in part.

Hole AF-36

Location: In woods between west frontage road and old Highway 51, 1200 feet west along section line from northeast corner Sec.16, T.3N., R.1W.

Elevation: 270 feet (from topographic map) Date: August 11, 1964

Purpose: Cored to 22 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
3	3	Soil, brown, sandy silt.
		Catahoula formation
3	6	Clay, tan, slightly silty.
9	15	Sand, light-gray, fine-grained, silty.
3	18	Clay, green, silty, hard.
4	22	Sand, gray-green, fine-grained, silty.

Hole AF-37

Location: On median between west frontage road and west lane of Interstate Highway 55 just north of Byram exit in SE.1/4, NE.1/4, Sec.13, T.4N., R.1E.

Elevation: 290 feet (from topographic map) Date: August 12, 1964

Purpose: Cored to 60 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
5	5	Road fill, gravel, sand.
		Catahoula formation
7	12	Sand, gray to yellow, fine-grained, silty.
		Vicksburg group (Bucatunna clay)
6	18	Clay, brown, with limonite partings.
42	60	Clay, dark-gray, smooth, with a few sand laminae, gypsiferous in upper 10 feet.

Hole AF-38

Location: 50 feet east of creek bank in approximate center NE.1/4, SW.1/4, Sec.7, T.7N., R.1W.

Elevation: 195 feet (from topographic map) Date: August 14, 1964

Purpose: Drilled to 490 feet for stratigraphic information. Descriptions from cuttings. Electrical log to total depth.

Thickness	Depth	Description
		Alluvium
36	36	Sand, white, fine- to coarse-grained, rare quartz and chert gravel, rare mica and carbonaceous material.
		Yazoo formation
14	50	Clay, gray-green, calcareous.
180	230	Clay, gray-green, calcareous, fossiliferous.
10	240	Clay, gray, very fossiliferous, calcareous.
160	400	Clay, gray-green, fossiliferous, calcareous.
15	415	Clay, gray-green, glauconitic, fossiliferous, slightly sandy.
		Moodys Branch formation
11	426	Marl, green, glauconitic, very fossiliferous, sandy.
		Cockfield formation
12	438	Clay, brown, micaceous, carbonaceous.
52	490	Silt, gray-brown, micaceous, sandy; clayey, silty clay in part.

Hole AF-39

Location: 120 feet southwest of back door of Mississippi Geological Survey building, NW.1/4, SE.1/4, Sec.27, T.6N., R.1E.

Elevation: 330 feet (from topographic map) Date: August 18, 1964

Purpose: Drilled to 360 feet to demonstrate new logging equipment and for stratigraphic information. Descriptions from cuttings. Electrical and gamma ray log to total depth.

Thickness	Depth	Description
		Yazoo formation
40	40	Clay, yellow, calcareous in lower part.
10	50	Clay, gray-green, calcareous, fossiliferous.
10	60	Clay, gray-green, very limy, glauconitic.
		Moodys Branch formation
12	72	Sand, gray-green, fine to medium-grained, fossiliferous, glauconitic, clayey.
		Cockfield formation
10	82	Clay, gray, micaceous, silty.
4	86	Sand, gray, fine-grained, silty.
56	142	Clay, gray, micaceous, silty, sandy in part.
18	160	Sand, gray, fine-grained, silty.
80	240	Clay, gray, micaceous, carbonaceous, very silty and sandy in part, clayey sand in part.
50	290	Clay, gray, silty, micaceous.
32	322	Sand, gray, fine-grained, silty, micaceous, carbonaceous.
		Cook Mountain formation
38	360	Clay, gray-brown, micaceous.

Hole AF-40

Location: 25 feet north of east-west gravel road in SW.1/4, SE.1/4, NW.1/4, Sec.5, T.7N., R.1W.

Elevation: 275 feet (from topographic map) Date: August 20, 1964

Purpose: Cored to 50 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
		Loess
7	7	Silt, tan.
		Terrace deposit
1	8	Sand, brown, coarse-grained.
		Yazoo formation
18.5	26.5	Clay, tan to brown, limonitic staining on fractures, gypsiferous in part.
15.5	42	Clay, blue-green, calcareous, rare fossils.
8	50	Clay, blue-green, calcareous, quite fossiliferous.

Hole AF-41

Location: 150 feet west of center line of old Highway 49 in center SW.1/4, Sec.10, T.7N., R.1W.

Elevation: 215 feet (from topographic map) Date: August 21, 1964

Purpose: Cored to 16 feet to obtain samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
		Loessal silt
14	14	Silt, tan, clayey, sandy in part.
2	16	Sand, tan, fine-grained.

Hole AF-42

Location: 10 feet east of AF-6 in NW.1/4, SW.1/4, NE.1/4, Sec.25, T.6N., R.3W.

Elevation: 210 feet (hand level) Date: August 21, 1964

Purpose: Cored to 19 feet to obtain samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
		Loessal silt
10	10	Silt, tan with gray mottling, clayey in part.
7	17	Silt, gray, clayey, sandy in lower part.
2	19	Sand, gray, very fine- to fine-grained, silty.

Hole AF-43

Location: 200 feet north of juncture of two asphalt roads in extreme northwest corner Sec.13, T.6N., R.3W.

Elevation: 225 feet (from topographic map) Date: August 24, 1964

Purpose: Cored to 21 feet to obtain samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
		Loessal silt
15	15	Silt, tan, slightly clayey in part, manganiferous material in upper 5 feet.
6	21	Silt, tan to yellow, clayey, sandy in part.

Hole AF-44

Location: Just off dirt field road in extreme southeast corner of Sec.16, T.5N., R.4W.

Elevation: 140 feet (from topographic map) Date: August 24, 1964

Purpose: Cored to 20 feet to obtain samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
1	1	Soil, tan, sandy silt.
		Loessal silt
14	15	Silt, tan, mottled with gray, slightly clayey in part.
3	18	Silt, gray, sandy, clayey.
2	20	Sand, gray, fine- to medium-grained.

Hole AF-45

Location: In field south of old Port Gibson road in SW.1/4, NW.1/4, SE.1/4, Sec.32, T.5N., R.3W.

Elevation: 175 feet (from topographic map) Date: August 24, 1964

Purpose: Cored to 16 feet to obtain samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
1	1	Soil, brown silt, plant material.
		Loessal silt
6	7	Silt, brown, tan and gray, manganiferous.
8	15	Silt, gray, sandy in lower part.
1	16	Sand, gray, fine- to coarse-grained, rare gravel.

Hole AF-46

Location: 30 feet south of gravel road on edge of colored church property in SW.1/4, SE.1/4, SW.1/4, Sec.4, T.4N., R.1W.

Elevation: 320 feet (from topographic map) Date: August 25, 1964

Purpose: Cored to 18 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
2	2	Sand, brown, very coarse-grained, chert gravel (driveway topping).
		Catahoula formation
11	13	Silt, gray, clayey, sandy.
5	18	Sand, gray, fine-grained, silty.

Hole AF-47

Location: 50 feet north of gravel road to Spring Hill Church in SW.1/4, SW.1/4, NW.1/4, Sec.26, T.4N., R.2W.

Elevation: 430 feet (from topographic map) Date: August 25, 1964

Purpose: Cored to 32 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
		Loess
2	2	Silt, tan.
		Terrace deposit
4	6	Sand, yellow, fine-grained, stained with iron.
6	12	Clay, red and gray, mottled, slightly sandy.
		Catahoula formation
5	17	Sand, gray, fine-grained, silty, slightly kaolinitic, stained yellow in part.
15	32	Clay, plastic, silty, with thin streaks of sand, gray, very fine- to fine-grained, silty.

Hole AF-48

Location: 2 feet east of AF-11 in NE.1/4, SW.1/4, NW.1/4, Sec.20, T.3N., R.2W.

Elevation: 355 feet (from topographic map) Date: August 26, 1964

Purpose: Cored to 30 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
		Loess
6	6	Silt, tan.
		Catahoula formation.
16	22	Clay, gray, plastic to silty.
2	24	Clay, gray, silty, sandy.
6	30	Sand, light-gray, very fine- to fine-grained, silty, slightly kaolinitic.

Hole AF-49

Location: In pasture 150 feet east of north-south blacktop road in SE.1/4, SE.1/4, SW.1/4, Sec.7, T.4N., R.3W.

Elevation: 300 feet (from topographic map) Date: August 26, 1964

Purpose: Cored to 25 feet to obtain clay samples for testing.

Thickness	Depth	Description
		Loess
6	6	Silt, tan.
		Catahoula formation
3	9	Clay, red to gray, sandy, silty.
3	12	Sand, gray, fine-grained, silty.
2	14	Clay, gray, sandy, silty.
11	25	Sand, gray, very fine- to fine-grained, silty.

Hole AF-50

Location: On west shoulder of gravel road, 2112 feet from south line and 2600 feet from west line, Sec.23, T.5N., R.2W.

Elevation: 332 feet (hand level) Date: August 28, 1964

Purpose: Drilled to 400 feet for stratigraphic information. Descriptions from cuttings. Electrical and gamma ray logs to total depth.

Thickness	Depth	Description
		Loess
4	4	Silt, tan to brown.
		Catahoula formation
14	18	Clay, gray, very silty, clayey siltstone in part.
3	21	Sandstone, very fine-grained, silty.
31	52	Clay, gray, very silty in part.
18	70	Clay, pale-green, silty, sandy.
28	98	Clay, gray, silty.
36	134	Clay, gray, silty, carbonaceous.
2	136	Sand, gray, very silty, clayey, rare glauconite.
28	164	Clay, gray, silty, sandy, clayey sand in part.
16	180	Clay, gray, silty, micaceous, carbonaceous.
4	184	Sand, gray, fine-grained, black chert, smoky quartz and lignite grains.
6	190	Clay, gray, silty, carbonaceous.

The following sand section occupies the approximate interval in which rocks of the *Vicksburg group* would normally be expected. Ideas on an explanation of this abnormal section are found in the section on Stratigraphy.

Thickness	Depth	Description
50	240	Sand, gray, fine- to coarse-grained, with many black or dark-gray grains of chert, smoky quartz, lignite and heavy minerals. Grain size increases toward the bottom of the sand, rare glauconite.
18	258	Clay, gray, silty, micaceous, sandy.
26	284	Sand, gray, fine- to coarse-grained, many black grains.
		Forest Hill formation
8	292	Clay, gray, silty, finely micaceous.
4	296	Sand, gray, fine-grained, argillaceous.
14	310	Clay, gray, silty, finely micaceous.
47	357	Sand, gray, fine-grained, very silty, clayey in part.
		Yazoo formation
13	370	Clay, pale-green, slightly calcareous.
30	400	Clay, gray-green, calcareous, fossiliferous (foraminifera).

Hole AF-51

Location: 50 feet east of gravel road, just south of Thompson Crossing of Yazoo and and Mississippi Valley railroad in SE.1/4, SE.1/4, Sec.2, T.5N., R.2W.

Elevation: 260 feet (from topographic map) Date: September 18, 1964

Purpose: Cored and drilled to 100 feet to obtain limestone and marl samples for analysis. Descriptions from cores to 60 feet, from cuttings 60 to 100 feet. Electrical and gamma ray logs to total depth.

Thickness	Depth	Description
		Terrace deposit
3	3	Sand, red to yellow, medium-grained.
		Vicksburg group (Byram marl and Glendon limestone—badly weathered in upper part)
9	12	Clay, brown to yellow, glauconitic, calcareous in part, limonitic.
10	22	Marl, brown to yellow, fossiliferous, glauconitic, limonitic in part.
3	25	Marl, green, glauconitic, fossiliferous, clayey, slightly sandy.
1.5	26.5	Limestone, gray, glauconitic, fossiliferous, argillaceous.
8.5	35	Marl, gray-green, clayey to slightly sandy, glauconitic, fossiliferous, soft limestone in part.
2	37	Limestone, gray, fossiliferous, glauconitic, slightly sandy.
8	45	Marl, gray-green, fossiliferous, clayey to slightly sandy, glauconitic.
		Vicksburg group (Mint Spring marl)
13	58	Sand, gray-green, calcareous, very fossiliferous, glauconitic.
		Forest Hill formation
20	78	Clay, gray, silty, micaceous, slightly carbonaceous.
22	100	Sand, gray, fine-grained, silty, micaceous.

Hole AF-52

Location: On north side of lake in pasture on Hugh D. Gillespie property in center of north half, SW.1/4, SE.1/4, Sec.22, T.5N., R.2W.

Elevation: 320 feet (from topographic map) Date: October 8, 1964

Purpose: Drilled to 485 feet for stratigraphic information. Descriptions from cuttings. Electrical log to total depth.

Thickness	Depth	Description
3	3	Soil, tan, sandy, silt.
		Catahoula formation
6	9	Sand, tan, fine-grained, silty.
57	66	Clay, tan to gray, silty and sandy in part, siltstone in part.
14	80	Sand, light-gray, very fine- to fine-grained, silty.
44	124	Clay, light-gray, silty, sandy in part.
8	132	Sand, tan to light-gray, very fine- to fine-grained, silty, kaolinitic, clayey.
34	166	Clay, gray-green, silty, pyritic.
		Vicksburg group (Bucatunna clay)
8	174	Clay, dark-gray, rare foraminifera.
4	178	Marl, gray-green, clayey, fossiliferous, glauconitic.
16	194	Clay, dark-gray, finely micaceous, very slightly calcareous.

		Vicksburg group (Byram marl)
15	209	Marl, gray-green, fossiliferous, clayey, glauconitic.
		Vicksburg group (Glendon limestone)
2	211	Limestone, gray, argillaceous, fossiliferous, glauconitic.
11	222	Marl, gray-green, glauconitic, fossiliferous, clayey, soft limestone in part.
2	224	Limestone, gray, glauconitic, fossiliferous, argillaceous.
12	236	Marl, gray-green, glauconitic, fossiliferous, sandy; thin beds of gray, argillaceous limestone.
		Vicksburg group (Mint Spring marl)
21	257	Sand, gray-green, medium-grained, glauconitic, very limy, fossiliferous, clayey in upper part.
		Forest Hill formation
29	286	Clay, gray, micaceous, silty, carbonaceous.
4	290	Sand, gray, fine-grained.
11	301	Clay, dark-gray, carbonaceous, silty.
7	308	Sand, gray, very fine- to fine-grained, silty.
10	318	Clay, gray, silty, sandy.
42	360	Clay, gray, micaceous, silty, sandy, clayey sand in part.
		Yazoo formation
40	400	Clay, gray-green, calcareous, fossiliferous.
54	454	Clay, light-gray, calcareous, fossiliferous.
2	456	Limestone, gray, argillaceous.
24	480	Clay, gray-green, calcareous, fossiliferous.

Hole AF-53

Location: 25 feet west of graveled private road on Alman property in NE.1/4, NW.1/4, SE.1/4, Sec.24, T.5N., R.2W.

Elevation: 345 feet (from topographic map) Date: October 9, 1964

Purpose: Drilled to 404 feet for stratigraphic information. Descriptions from cuttings. Electrical log to total depth.

Thickness	Depth	Description
		Loess
10	10	Silt, tan.
		Catahoula formation
18	28	Clay, buff, silty, sandy in part.
6	34	Siltstone, white, clayey, sandy.
21	55	Sand, white, very fine- to fine-grained, silty, clayey in part.
49	104	Clay, light-gray to white, very silty, sandy in part, rare pyrite.
10	114	Clay, gray, silty, sandy, carbonaceous and sand, gray, very fine-grained, clayey, carbonaceous, rare glauconite.
24	138	Clay, light-gray, silty, finely micaceous.
10	148	Sand, gray, fine- to coarse-grained, many black grains, chert, smoky quartz, heavy minerals.
		Vicksburg group (Bucatunna clay)
19	167	Clay, dark-gray, plastic, slightly calcareous.
		Vicksburg group (Byram marl)
12	179	Marl, gray-green, glauconitic, fossiliferous, clayey.
		Vicksburg group (Glendon limestone)
2	181	Limestone, gray, glauconitic, fossiliferous, argillaceous, chalky in appearance.
12	193	Marl, gray, glauconitic, fossiliferous, slightly clayey.
1	194	Limestone, gray, glauconitic, fossiliferous, argillaceous.
20	214	Marl, gray to gray-green, glauconitic, fossiliferous, slightly sandy; soft limestone in part.

		Vicksburg group (Mint Spring marl)
18	232	Sand, gray-green, fine- to coarse-grained, clayey in upper part, glauconitic, fossiliferous.
		Forest Hill formation
7	239	Clay, dark-gray, finely micaceous.
5	244	Sand, gray, very fine-grained, silty.
3	247	Clay, gray, silty, micaceous.
7	254	Sand, gray, very fine- to fine-grained, micaceous, silty.
68	322	Clay, gray, silty, micaceous, carbonaceous; silty, clayey sand in part.
14	336	Sand, gray, very fine- to fine-grained, silty.
		Yazoo formation
68	404	Clay, gray to gray-green, calcareous, fossiliferous in part.

Hole AF-54

Location: In pasture 100 yards east of dirt trail in NW.1/4, NE.1/4, SE.1/4, Sec.10, T.7N., R.4W.

Elevation: 220 feet (from topographic map) Date: October 12, 1964

Purpose: Drilled to 120 feet for stratigraphic information. Descriptions from cuttings. Electrical log to total depth.

Thickness	Depth	Description
		Loess
10	10	Silt, tan, some manganiferous material.
28	38	Silt, tan to buff, few snail shells.
		Pre-loess alluvium
29	67	Clay, brown, yellow, buff, mottled, silty, sandy.
13	80	Sand, gray, fine- to coarse-grained, clayey, carbonaceous.
17	97	Sand, white, fine- to very coarse-grained, quartz and chert gravel.
		Forest Hill formation
17	114	Clay, gray, silty, micaceous, carbonaceous.
6	120	Sand, gray, fine-grained, silty.

Hole AF-55

Location: 20 feet north of dirt field road in approximate center SE.1/4, SE.1/4, Sec.3, T.7N., R.4W.

Elevation: 220 feet (from topographic map) Date: October 12, 1964

Purpose: Drilled to 55 feet for stratigraphic information. Descriptions from cuttings. Lost hole, no electrical log.

Thickness	Depth	Description
		Loess
35	35	Silt, tan to buff with snail shells in upper part.
		Terrace deposit
7	42	Clay, tan to yellow, silty, very sandy.
6	48	Sand, fine- to very coarse-grained, with quartz and chert, gravelly, clayey.
		Vicksburg group (badly weathered)
7	55	Clay, brown to yellow, limonitic, glauconitic, fossiliferous, trace marl, green, glauconitic, clayey, fossiliferous.

Hole AF-56

Location: 25 feet south of gravel private road in approximate center SW.1/4, SW.1/4, Sec.3, T.6N., R.4W.

Elevation: 205 feet (from topographic map) Date: October 14, 1964

Purpose: Drilled and cored to obtain limestone and marl samples for analysis. Descriptions from cuttings 0-80 feet, from cores 80-109 feet, from cuttings 109-130 feet. Electrical log to total depth.

Thickness	Depth	Description
		Loess
26	26	Silt, tan, snail shells in upper part.
		Terrace deposit
9	35	Clay, yellow, sandy.
		Catahoula formation
9	44	Clay, gray, plastic to very sandy in lower part.
		Vicksburg group (Bucatunna clay)
10	54	Clay, gray, slightly glauconitic.
6	60	Marl, gray-green, glauconitic, fossiliferous, clayey.
8	68	Clay, dark-gray, glauconitic.
		Vicksburg group (Byram marl)
11	79	Marl, gray-green, fossiliferous, glauconitic, limy clay in part.
		Vicksburg group (Glendon limestone)
2	81	Limestone, gray, glauconitic, fossiliferous, argillaceous.
5	86	Marl, gray, glauconitic, fossiliferous, clayey.
2	88	Limestone, gray, fairly hard, fossiliferous, glauconitic.
2	90	Marl, gray, glauconitic, fossiliferous, clayey.
2	92	Limestone, gray, glauconitic, fossiliferous, argillaceous, rare sand grains.
5	97	Marl, gray-green, glauconitic, fossiliferous, clayey to slightly sandy.
2	99	Limestone, gray, glauconitic, fossiliferous, slightly sandy.
22	121	Marl and soft limestone, gray-green, glauconitic, fossiliferous, clayey to sandy.
		Vicksburg group (Mint Spring marl)
9	130	Sand, gray-green, very limy, very glauconitic, fossiliferous.

Hole AF-57

Location: 25 feet west of center line of north-south asphalt road, just south of Turkey Creek in SE.1/4, NE.1/4, SE.1/4, Sec.20, T.5N., R.3W.

Elevation: 185 feet (hand level) Date: October 7, 1964

Purpose: Cored to 28 feet for stratigraphic information. Descriptions from cores. No electrical log.

Thickness	Depth	Description
		Loess
7	7	Silt, tan.
		Catahoula formation
8	15	Sand, gray to tan, fine- to medium-grained, stained with iron in part.
4	19	Clay, gray, plastic to silty.
4	23	Sand, yellow to gray, fine- to medium-grained.
		Vicksburg group (Bucatunna clay)
5	28	Clay, brown, plastic, with limonitic partings.

Hole AF-58

Location: 50 feet south of center line of U. S. Highway 80 in NW.1/4, NW.1/4, SW.1/4, Sec.23, T.6N., R.2W.

Elevation: 318 feet (hand level) Date: October 15, 1964

Purpose: Cored to 48 feet to obtain clay samples for testing. Descriptions from cores. No electrical log:

Thickness	Depth	Description
		Loess
2	2	Silt, tan.
		Catahoula formation
8	10	Clay, gray, very silty, very sandy.
7	17	Sand, gray, clayey, silty.
5	22	Clay, gray to purple, silty.
5	27	Sand, gray, fine-grained, silty, clayey, limonitic staining in part.
5	32	Clay, tan, plastic, sandy and silty in part.
5	37	Clay, green, silty and sandy in part.
4	41	Sand, gray-green, fine-grained, silty, carbonaceous.
7	48	Sand, gray to green, fine-grained, lignitic in part, glauconitic, very glauconitic in bottom 2 feet. (This interval is a transition zone between Catahoula formation and the Vicksburg group.)

Hole AF-59

Location: Just east of colored home on dirt trail in SW.1/4, SE.1/4, NW.1/4, Sec.23, T.6N., R.2W.

Elevation: 308 feet (hand level) Date: October 15, 1964

Purpose: Cored to 27 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
1	1	Soil, brown, sandy, silt.
		Catahoula formation
6	7	Clay, purple, very silty.
10	17	Clay, yellow to tan, tough with limonite staining on fractures and streaks of sand, yellow, medium-grained.
10	27	Clay, tan to yellowish, tough, blocky.

Hole AF-60

Location: 100 feet south of center line of U. S. Highway 80 in NW.1/4, SW.1/4, Sec.23, T.6N., R.2W.

Elevation: 312 feet (hand level) Date: October 15, 1964

Purpose: Cored to 36 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
1	1	Soil, tan, sandy, silt.
		Catahoula formation
15	16	Clay, purple, sandy, silty in part, clayey silt in part.
3	19	Clay, tan, blocky, tough, sandy, with limonite staining on fractures and on sand.
11	30	Clay, tan, tough, limonite staining on fractures.
2	32	Clay, green, blocky tough.
4	36	Clay, gray, silty, sandy, fine-grained sand in part.

Hole AF-61

Location: 50 feet south of pond, just north of center of NW.1/4, SW.1/4, Sec.23, T.6N., R.2W.

Elevation: 306 feet (hand level) Date: October 15, 1964

Purpose: Cored to 27 feet to obtain clay samples for testing. Descriptions from cores. No electrical log.

Thickness	Depth	Description
1	1	Soil, tan, sandy, silt.
		Catahoula formation
3	4	Clay, purple, silty, sandy.
4	8	Sand, gray, fine-grained, clayey, silty.
5	13	Sand, yellow, fine- to medium-grained with streaks of clay, tan, plastic, tough.
13	26	Clay, tan to pale-green, tough, blocky.
1	27	Clay, gray, silty, sandy.

Hole AF-62

Location: In pasture just west of dirt trail on J. R. Enochs property in NW.1/4, SW.1/4, Sec.23, T.5N., R.2W.

Elevation: 320 feet (from topographic map) Date: November 12, 1964

Purpose: Drilled and cored to 300 feet for stratigraphic information. Descriptions from cuttings 0-120 feet, from cores 120-145 feet, from cuttings 145-170 feet, from cores 170-175 feet, from cuttings 175-200 feet, from cores 200-205 feet, from cuttings 205-215 feet, from cores 215-240 feet, from cuttings 240-300 feet. Electrical log to total depth.

Thickness	Depth	Description
2	2	Soil, tan, sandy silt.
		Catahoula formation
22	24	Silt, gray, clayey, sandy in part, siltstone in part.
8	32	Clay, light-gray, silty.
10	42	Sandstone, gray, fine-grained, clayey, very silty.
18	60	Clay, gray, sandy, silty.
12	72	Siltstone, gray, very sandy, sandstone in part.
28	100	Clay, light-gray, silty, sandy and siltstone, gray, clayey, sandy.
20	120	Clay, gray, silty.
5	125	Sandstone, gray, very fine-grained, very silty, clayey.
5	130	Clay, gray, silty, sandy.
6	136	Sand, gray, fine-grained, very silty, clayey, kaolinitic.
10	146	Clay, green, tough, blocky, swells and caves in hole.
16	162	Siltstone, gray, clayey, sandy.
5	167	Sand, gray, fine-grained, silty, clayey, rare glauconite.
		Vicksburg group (Bucatunna clay)
20	187	Clay, dark-gray to black, slightly silty, calcareous in part.
		Vicksburg group (Byram marl)
12	199	Marl, gray-green, glauconitic, fossiliferous, clayey.
		Vicksburg group (Glendon limestone)
3	202	Limestone, gray, glauconitic, fossiliferous, argillaceous.
8	210	Marl, gray, glauconitic, fossiliferous, clayey, slightly sandy.
2	212	Limestone, gray, glauconitic, fossiliferous, hard.
22	234	Marl, gray-green, glauconitic, fossiliferous, sandy; soft limestone in part.

		Vicksburg group (Mint Spring marl)
5	239	Marl, green, clayey, glauconitic, fossiliferous, slightly sandy.
8	247	Sand, green, fine- to coarse-grained, fossiliferous, glauconitic.
		Forest Hill formation
14	261	Clay, gray, silty, micaceous.
19	280	Silt, gray, micaceous, carbonaceous, clayey, sandy; silty sand in part.
14	294	Sand, gray, fine-grained, silty, clayey.
6	300	Clay, gray, silty, micaceous.

Hole AF-63

Location: 200 feet north of water well on C. F. Grant property on north side of State Highway 18 in SW.1/4, SW.1/4, NW.1/4, Sec.28, T.5N., R.1W.

Elevation: 352 feet (by Hinds County surveyor) Date: February 2, 1965

Purpose: Cored and drilled to 70 feet to obtain clay samples for testing. Descriptions from cores 0-66 feet, from cuttings 66-70 feet. Electrical log to total depth.

Thickness	Depth	Description
		Loess
8	8	Silt, tan to yellow.
		Terrace deposit
4	12	Clay, red to brown, sandy, with a few pieces of chert gravel.
		Catahoula formation
5	17	Sand, red to yellow, with thin streaks and blebs of clay, tan, blocky.
11	28	Clay, tan, tough, blocky with limonite staining on fractures, few thin sand laminae.
		Vicksburg group (Bucatunna clay)
4	32	Marl, yellow, brown, clayey, glauconitic, slightly fossiliferous.
8	40	Marl, green, fossiliferous, glauconitic, clayey.
13	53	Clay, dark-gray, fossiliferous in part, thin silt laminae.
		Vicksburg group (Byram marl)
13	66	Marl, gray-green, fossiliferous, glauconitic, clayey, limy clay in part.
		Vicksburg group (Glendon limestone)
3	69	Limestone, gray, fossiliferous, glauconitic, hard.
1	70	Marl, green, very glauconitic, fossiliferous, slightly sandy.

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HINDS COUNTY STRUCTURAL GEOLOGY

ALVIN R. BICKER, JR.

ABSTRACT

In an effort to relate the shallow subsurface to the deep geology, structure maps were constructed using the Glendon limestone and the Moodys Branch marl as shallow datum-planes. The Wilcox and the base of the Midway shale were selected to illustrate the structural features at greater depths. In areas of known subsurface structure the shallow maps reflect the uplift of the deeper beds. An isopachous map of the interval from the top of the Wilcox to the base of the Midway shale shows considerable thickening of this interval in the western portion of Hinds County.

INTRODUCTION

Time was not available for an extensive study of the deep subsurface geology of the County. For the report to have been conclusive many thousands of feet of well cuttings would have had to have been examined, electrical logs studied, correlations made and maps constructed. As personnel and time were limited, the decision was made to postpone study of the deeper subsurface at this time. The deeper geology will be the basis of future investigation. The Midway was selected as the oldest stratigraphic unit to be studied and mapped in conjunction with this report.

Electrical logs provided data for all maps with one notable exception. In the areas of the Jackson Dome control for the base of the Midway shale map (Plate 1) was supplied by previous determinations, as electrical logs of the early wells were not available.

The Wilcox map (Plate 2) was constructed to show the structural configuration at intermediate depths. An isopachous map (Plate 3) of the interval between the top of the Wilcox and the base of the Midway shale is included as an additional study of the structural relationship of these two units.

An extraordinary number of electrical logs of core holes and water wells were available for investigation of the shallow formations. A number of oil companies had made previous studies of the shallow units through extensive programs of core hole drilling. Logs of many of these core holes were released to the Survey for this investigation. The large number of logs provided data for the most detailed maps. Distribution was such that all areas except the southwestern and northwestern corners of the County were amply covered with control for structural interpretation of the shallow units.

The Moodys Branch marl (Plate 4) and the Glendon limestone (Plate 5) were selected as datum-horizons for mapping shallow structure. The purpose for mapping both units was two-fold, first to show the structural relationship between the two units and second, that one would supplement the other as an indication of deeper structure. Included in the study of the shallow units is an isopachous map (Plate 6) of the interval between the Glendon limestone and the Moodys Branch marl.

Locations of the wells on each map were obtained from the logs of these wells. Where possible the accuracy of the locations were compared to other sources. On Plates 2, 4, 5 and 6 only those wells are shown that provided control data for the respective maps.

GENERAL STRUCTURE

In regard to regional structure, Hinds County is located on the east flank of the Mississippi Embayment, a large geosyncline. The axis of the Embayment is near the western boundary of the County. Mellen[1] locates the axis in eastern Warren County, near Bovina. Locally many geologists refer to the axis as the Big Black syncline.

The east flank of the Embayment forms a homoclinal structure across most of the central part of the State. The regional southwest dips are interrupted in places by local uplift. In eastern Hinds County the regional dips are disturbed over a wide area by the uplift of the Jackson Dome. In this area the dips are reversed and accentuated by the large structure. West of the Jackson Dome the dips are interrupted to some extent by uplift of salt dome structures.

Plate 7, a west-to-east cross section through central Hinds County, shows to some extent the regional dip and the effect of uplift. The magnitude of the dip on the shallow beds is less than that of the deeper formations. This is a result of down dip thickening of the Midway and Wilcox groups, a condition readily evident on the cross section.

SUBSURFACE STRUCTURE

The known subsurface structural uplifts are all indicated to some extent on the structure maps included with this report. These features have been proven by subsequent drilling of deep tests in the search for oil and gas. Positive structural features are the Jackson Dome, the Brownsville, Carmichael, Edwards, Halifax, Learned and Oakley Salt Domes and the Bolton Oil Field. The locations of these uplifts are shown on the key map of each structure map.

JACKSON DOME

The existence of structural uplift at Jackson was probably first recognized by Hilgard[2] in 1860. His observation of the surface strata led him to postulate that the appearance of the basal Jackson group at this location was due to local uplift. Hopkins[3], investigating the possibility of accumulation of oil and gas, mapped the area using the Glendon limestone as a reference datum. From his work he described a broad anticline in the Jackson area. Monroe and Toler[4] and Monroe[5] using available well data showed the structure as contoured on top of the Clayton formation.

The Jackson Dome is located in Hinds and Rankin Counties. It is a broad structural uplift approximately 25 miles wide, slightly elongated to the northwest and the northeast. The City of Jackson occupies the area of highest relief over the Dome.

On the flanks of the Dome dips vary with depth and direction. Dips on the base of the Midway shale average 200 feet to the mile to the northwest. Those to the southwest approach 400 feet to the mile. Dips on the Wilcox group are more consistent and average from 200 to 250 feet per mile. The Moodys Branch marl has dips from 50 to 100 feet per mile depending upon its position on the flank. The greatest dip in the Moodys Branch is roughly coincident with the outcrop belt of the Forest Hill beds. This increase of dip of the Moodys Branch can be seen on the cross section of the Jackson Dome (Plate 2, Moore).

The irregular configuration of the base of the Midway shale map near the crest of the Dome probably reflects irregular surface of the reef-like Jackson "Gas Rock" and is not a true indication of the structure.

Although faulting is commonly associated with structures of this magnitude none is shown on the structure maps. However, Plates 1 and 2 show a synclinal area in T.6N., R.1E., that could be reflection of faulting in the deeper beds.

BROWNSVILLE SALT DOME

The Brownsville Salt Dome is centered in Sections 10 and 15, T.7N., R.2W., 3 miles northeast of the community of Brownsville. Existence of the Dome was proven in 1947, when the Gulf Refining Company's No. 1 Trotter drilled into the salt stock. Two other wells penetrated into the salt, encountering the stock at different depths. In the northwest quarter of Section 10 the salt was found at a depth of 4743 feet.

At the Brownsville Dome, structural conditions differ somewhat to those encountered at other domes in the County. The salt stock is encompassed by Cretaceous rocks, whereas at other domes salt has penetrated into starta of the Wilcox group. As a result, the Midway shale is present over the structure and the uplift can be identified on Plate 1. Another notable difference is the attitude of the Moodys Branch marl. The marl datum indicates a sharp depression or syncline in the area of highest salt penetration. The low can be easily identified on Plate 4.

The structure map of the Wilcox (Plate 2) indicates downdip relief to the southeast in excess of 200 feet on top of the Wilcox. The magnitude of relief is greater than at some domes where the salt has penetrated into the Wilcox.

The south and west dips recorded on the Glendon limestone (Plate 5) in Sections 16 and 17, suggest structure in the area. However, the Glendon crops out and is not present over the entire Dome. In the well containing the low Moodys Branch marl datum, the Glendon cannot be identified, because the electrical log was not recorded through the Glendon section. Therefore, it cannot be shown that the limestone would be low in this area. However, if it is low, the structural relationship to the marl will be altered because of thickening in the Yazoo clay.

Five oil test wells were drilled in the immediate area of the Brownsville Dome. Although none were successfully completed, shows of oil and gas were encountered in the Wilcox and Cretaceous strata.

CARMICHAEL SALT DOME

The Carmichael Salt Dome was discovered in 1949 by the drilling of the Southeastern Drilling Company's No. 1 Lewis-Ervin. This well was located in Section 27, T.3N., R.3W., and is the only test drilled in this area.

Salt was encountered at a depth of 2966 feet. Caprock and salt penetrated into strata of the Wilcox group, uplifting the remaining Wilcox strata. Data is not available to indicate dips on top of the Wilcox. However, the Wilcox datum is found about 1000 feet higher than it would be if regional dips were projected through the area.

Both the Moodys Branch marl and the Glendon limestone show structure in the shallow beds. The Moodys Branch marl has east dip of over 250 feet and southeast dip of more than 300 feet. The uplift of the Glendon limestone shows dips of about 100 feet to the northwest and more than 200 feet to the southeast.

EDWARDS SALT DOME

The Edwards Salt Dome is centered in Sections 26 and 35, T.6N., R.4W., about one mile east of the town of Edwards. The Dome was one of the earliest recognized salt domes in Mississippi. In 1937 Southern Natural Gas Company drilled a test well in the NE.¼, NW.¼ of Section 35, that found the salt core at a depth of 3124 feet, below strata of the upper Wilcox group.

Three other tests were drilled in the immediate area of the Dome, one of these penetrated into Cretaceous rocks, one stopped in Wilcox and the other reported salt at total depth.

The highest point of structural uplift on top of the Wilcox is found in the area of the discovery well. From this test there is 567 feet of dip to the northeast and 392 feet to the south.

The shallow markers do not offer conclusive evidence of the uplift over the Dome. The Moodys Branch marl (Plate 4) and Glendon limestone (Plate 5) both show west dip. However, the isopach map (Plate 6) of the interval between the Glendon and the Moodys Branch does show thinning in the area. This thinning could be caused by compaction of the sediments over the salt core.

HALIFAX SALT DOME

The Halifax Salt Dome was discovered in 1941 by the drilling of the Plains Production Company's No. 1 Halifax. This test was drilled in the NW.¼ of Section 1, T.7N., R.4W. At this location salt was encountered at a depth of 3995 feet. The electrical log of this well shows approximately 1100 feet of Wilcox strata remaining over the salt core.

A second test drilled in Section 7, T.7N., R.3W., one and one-half miles east-southeast of the discovery well, found the Wilcox 179 feet low.

The dip of the Moodys Branch marl between the two wells is reversed, the second test being 44 feet high to the discovery well. The Glendon limestone map (Plate 6) also shows west dip over the Dome. The condition causing the reversal of dips in the shallow formations cannot be determined from the limited data available, however, such structural conditions could exist if faulting is associated with the salt uplift.

LEARNED SALT DOME

The Learned Salt Dome is located approximately three miles northwest of the town of Learned. Existence of the structure was proven by the drilling of The Texas Company's No. 1 Noble-Minerals, in the SE.¼, NE.¼, Section 35, T.5N., R.4W. After drilling 1464 feet into the Wilcox, caprock was encountered at 4429 feet and the salt at 4437 feet. A second test drilled in the SE.¼ of Section 35, was abandoned in strata of Cretaceous age at the depth of 9021 feet.

Recorded dip of the Wilcox on the Learned Salt Dome is less than at any other proven salt dome in the County. Comparison of the two wells shows only 30 feet of south dip present at the top of the Wilcox. The amount of salt penetration is similar to that at the Halifax structure and it appears that more relief on the Wilcox could be expected. It is probable that additional well control to the northeast may show more relief. The structure map of the Glendon limestone (Plate 5) shows more evidence of uplift than either the Wilcox or Moodys Branch marl map.

OAKLEY SALT DOME

The Oakley Salt Dome is the only piercement type dome in the County from which oil has been produced. The Dome was discovered in 1949 when the Sun Oil Company's No. 1 Shuff, in the SE.¼, SE.¼, Section 27, T.5N., R.3W., drilled into the caprock at a depth of 2613 feet. Five years later the Walter Sistrunk No. 1-A Shuff Unit, in the SE.¼, SE.¼ of Section 27, was completed as an oil producer. The producing well encountered the caprock at a depth of 2416 feet, 222 feet below the top of the Wilcox.

The maximum amount of relief on the Wilcox is indicated by well control to the east. Between the producing well and a test in the SW.¼, Section 25, T.6N., R.3W., there is 640 feet of east dip.

The Moodys Branch marl reflects the east dip found on top of the Wilcox. Dips between wells in the SE.¼ of Section 27 are so abnormal that the interpretation presented herein is that faulting has occurred. Supporting the interpretation of the fault is an increase of 100 feet in the thickness of the Yazoo clay in the well on the downthrown side of the fault.

BOLTON OIL FIELD

The Bolton Field is centered in Sections 13 and 24, T.6N., R.3W., and Sections 18 and 19, T.6N., R.2W. Discovery of the structure was a result of seismic exploration of a gravity prospect having surface geological anomaly. Development drilling defined the uplift as an elongated anticline, with graben-type faulting at depth. The longitudinal axis of the anomaly trends northwest-southeast.

The structure is shown on the base of the Midway shale map and the Wilcox map (Plates 1 and 2) as nosing, the structural indications being more pronounced on the Wilcox datum. Presence of the "Gas Rock" with its variable thickness and the downdip thickening of the Midway and Wilcox groups mask the east dip shown by deeper formations. A smaller contour interval on Plate 2 would enhance the structural interpretation and could possibly reflect the east dip found on other datum-planes.

The Moodys Branch marl and the Glendon limestone maps (Plates 5 and 6) both indicate the structure. Dip can be found in all directions from the crest of the shallow features.

OTHER AREAS

Present structural interpretation reveals areas which suggest possibilities of other anomalies in the County. Additional data may provide more detail to the structures or disprove their existence. The areas are listed herein to focus attention on their possibilities.

Located in T.4N., R.4W., on the key map of Plate 5 is the notation "Hubbard Dome." Although the existence of a salt dome has not been proven by drilling, structural conditions have been interpreted to indicate one. The structure maps of the Moodys Branch marl and the Glendon limestone show a sharp depression centered in Section 6 (Plates 4 and 5). Dips into the depression on both data exceed 180 feet in a distance of one-half mile. Plate 6 shows the interval between the two units to be thin. Similar conditions are present in the Moodys Branch at the Brownsville Salt Dome. The interpretation on Plate 2 indicates this anomalous area to be farther north in Section 31, T.5N., R.4W.

The Wilcox map (Plate 2) indicates structural disturbance centered in Sections 8 and 17, T.5N., R.4W. This interpretation is based on poor well control and the feature is defined in more detail in the shallow horizons. The Glendon limestone map (Plate 6) shows the maximum uplift to be centered in Section 9.

Plates 5 and 6 show uplift in the area between the Edwards and Learned Salt Domes. This area is centered in Sections 11, 12 and 13, T.5N., R.4W. The north-northwest trending fault in Sections 11 and 12 on the shallow maps has been interpreted from the abnormal dips on the Glendon limestone that exist between the wells and reported outcrops. This fault is also noted on the geologic map of Mississippi (1945)[6]. On Plate 2, the structural interpretation is based on the Wilcox datum of the dry hole in Section 12. The top of the Wilcox at this location is 82 feet high to the Wilcox datum at the Learned Salt Dome. This dry test was abandoned at a total depth of 4566 feet in strata of the Wilcox group.

The divergence of the contours on the Wilcox maps in T.6N., R.3W., suggests structural disturbance. The interpretation from the limited control indicates the entire township to be favorable. However, the shallow markers show a broad uplift centered in Sections 20, 21, 28 and 33. The broad uplift is similar to that found in the shallow beds over the Bolton Field, 4 miles to the northeast. An oil test in the NE.¼ of Section 29 was abandoned at a total depth of 9001 feet. This well was drilled before the discovery of the Bolton Field and did not penetrate to sufficient depths to test formations that are productive in the Bolton area.

Another area of structural disturbance is found north of the Edwards Salt Dome. The feature has been the object of five unsuccessful tests. The interpretation on the base of the Midway shale and Wilcox maps (Plates 1 and 2) show nosing in the area. The Glendon limestone map (Plate 6) indicates a broad area of uplift centered in Section 35, T.7N., R.4W.

The divergence of contours on Plates 1 and 2 suggests uplift in Sections 20 and 29, T.4N., R.3W., and Sections 9 and 10, T.3N., R.4W. These areas are indicated to be anomalous on the Moodys Branch marl and Glendon limestone maps.

There are numerous other areas that indicate local structure on the shallow Moodys Branch marl and Glendon limestone maps. Lack of deep well control prohibits accurate interpretation of these uplifts on the Wilcox or base of the Midway shale map. Further well control will be necessary before these areas can be detailed on the deep horizons.

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HINDS COUNTY WATER RESOURCES

A. R. BICKER, JR., W. S. PARKS AND W. H. MOORE

ABSTRACT

The five major ground water aquifers in Hinds County are, in ascending order, the Wilcox group and the Kosciusko, Cockfield, Forest Hill and Catahoula formations. The Wilcox group is virtually undeveloped, and its potential is unknown. However, electrical log studies show that its importance as a source of fresh-water is limited to the northeastern part of the County. Isopachous maps showing net water sand thicknesses in the Kosciusko, Cockfield, Forest Hill and Catahoula formations provide useful tools in predicting the thicknesses of water sand to be expected in the drilling of water wells and in predicting the ground water resources available for development at specific localities. Planimetry studies of the isopachous maps indicate an estimated volume of fresh-water reserve in these four aquifers to total about 16.6 trillion gallons. The Kosciusko with about 9.8 trillion gallons and the Cockfield with about 4.5 trillion gallons are the most important reservoirs. Major streams which provide sources of surface water are the Pearl River and the Big Black River. The major impounded waters are the Ross Barnett Reservoir and Lake Hico.

INTRODUCTION

This report on water resources was prepared as a part of the regular geological investigation of Hinds County because of the ever-increasing demand for information concerning water supplies. Daily the Survey receives requests from water well contractors, engineers, public officials, representatives of industry and landowners. These individuals recognize that the study of water resources, especially the finding of ground water supplies, is basically a geological problem. Too often, water supplies are planned without competent geological advice. Consequently, this poor planning has resulted in the loss of thousands of dollars by the public and industry.

The collection, compilation and publication of water resources information are continuing endeavors. There are several previously published reports that contain pertinent data concerning the water resources of the County. These reports are listed in the section entitled "Selected References." The present report adds substantially to this existing information inasmuch as it presents data not available for the previous studies.

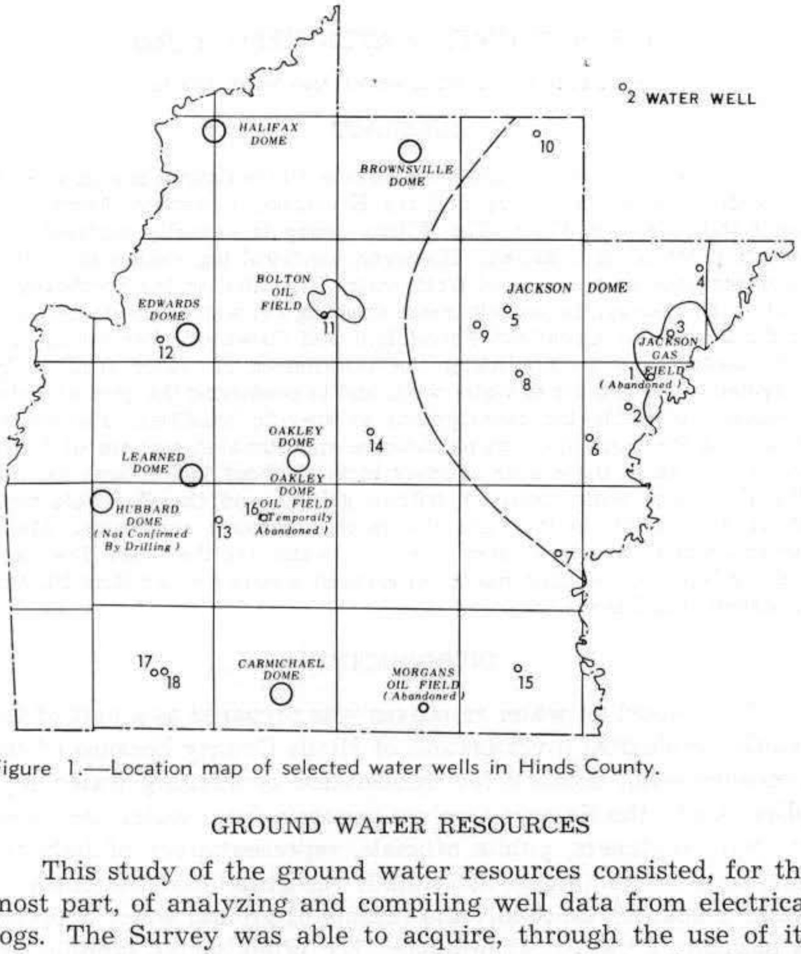

Figure 1.—Location map of selected water wells in Hinds County.

GROUND WATER RESOURCES

This study of the ground water resources consisted, for the most part, of analyzing and compiling well data from electrical logs. The Survey was able to acquire, through the use of its logger and donations of electrical logs, a volume of well data never before available for the preparation of a county report. This information permitted the making of detailed isopachous and structure maps which are useful in predicting the thicknesses of, and the depths to, the water-bearing sands. From the isopachous maps it is also possible to make predictions as to the ground water resources available to individuals, municipalities, and industries for present and future needs.

The five major aquifers in the County are, in ascending order, the Wilcox group and the Kosciusko (Sparta), Cockfield, Forest Hill and Catahoula formations. The Wilcox is virtually undeveloped, and its potential is unknown. The volume of water in the fresh-water bearing sands of the Kosciusko, Cockfield, Forest Hill and Catahoula formations is estimated to total about 16.6 trillion gallons (Table 1).

Table 1

Planimetry Study of the Four Major Ground Water Reservoirs*

Aquifer	Accuracy of planimetry (percent error)	Acre-feet of fresh-water sand	Water** (in millions of gallons)	Percent of total reservoirs
Kosciusko	0.29	100,502,115	9,824,795	59
Cockfield	0.04	45,619,975	4,459,676	27
Forest Hill	0.02	15,313,445	1,496,998	9
Catahoula	0.37	8,582,210	838,972	5
Totals		170,017,745	16,620,441	100

*Planimetry study of the isopachous maps (Plates 1, 2, 3 and 4); See the section entitled "Explanation of Maps" for description of procedures.

**Figure based on an estimated 30 percent porosity in the sands.

The five major aquifers are described only generally herein. A discussion of the stratigraphic sequence of the formations present in the County is not included in order to avoid repetition in the bulletin. More specific information as to the geology of the units is given in "Hinds County Geology." The records of selected water wells are given in Table 2; the locations of the wells are shown in Figure 1; and the analyses of water samples are given in Table 3.

Table 2

Records of Selected Water Wells

Well No.	Owner	Driller	Date Completed	Depth of Well (ft.)	Diameter of Well (in.)	Water-Bearing Unit[1]	Altitude of lsd (ft.)	Water Level: Above(+) or below lsd (feet)	Water Level: Date of measurement	Reported Yield (gpm)	Method of Lift[2]	Use of Water[3]	Remarks
1	King Edward Hotel	Layne-Central Co.	1903	1446	-	Wx	282	+3	1959	-	-	P	Well flows.
2	State Poultry Co.	- do -	1964	756	12x8	Kos	275	159	@Comp.	572	T	I	
3	VA Hospital	Forest Drlg. Co.	1962	768	4	Kos	350	72	@Comp.	10	S	P	Emergency stand-by fall-out shelter
4	Hinds County Water	Layne-Central Co.	1955	803	8x6	Kos	325	160	@Comp.	151	T	P	
5	Town of Clinton	- do -	1963	924	12x8	Kos	314	191	@Comp.	560	T	P	
6	Woodbine Water Co.	D.F. Berry	1948	1000	6x3	Kos	305	160	1956	200	T	P	
7	Stanton Prestressed	Delta Drlg. Co.	1964	1502	4x3	Kos	285	80	@Comp.	50	S	I	
8	Waterways Exp. Sta.	Carloss Well Supp.	1949	637	10	Cf	350	222	1957	200	T	I	
9	Town of Clinton	Layne-Central Co.	1961	724	12x8	Cf	359	228	@Comp.	480	T	P	
10	Village of Pocahontas	Enloe Tool Co.	1957	786	4	Cf	240	89	@Comp.	85	S	P	
11	Town of Bolton	Layne-Central Co.	1955	1034	10x6	Cf	215	76	@Comp.	400	T	P	
12	Town of Edwards	- do -	1949	1106	10x8	Cf	220	100	@Comp.	256	T	P	
13	Village of Learned	R.G. McNeece	1962	1150	4x2½	Cf	200	70	@Comp.	50	S	P	
14	Town of Raymond	Layne-Central Co.	1931	1175	12x8	Cf	320	169	@Comp.	93	T	P	
15	Town of Terry	- do -	1952	473	10x6	FH	300	60	@Comp.	201	T	P	
16	Brown Loam Exp. Sta.	Carloss Well Supp.	1955	148	8	Ca	225	43	@Comp.	55	T	D,S	
17	Town of Utica	Layne-Central Co.	1945	240	10x8	Ca	215	10	@Comp.	200	T	P	Owned by L-Central
18	Town of Utica	- do -	1957	298	12x6	Ca	205	11	@Comp.	-	T	P	Owned by L-Central

[1] Wx=Wilcox group, Kos=Kosciusko formation, Cf=Cockfield formation, FH=Forest Hill formation, Ca=Catahoula formation.
[2] T=Turbine, S=Submersible.
[3] P=public, I=industrial, D=domestic, S=stock.

(SEE TABLE 3 FOR OTHER DATA)

Table 3

Analyses of Water Samples by the Mississippi State Board of Health

(Chemical Constituents in Parts per Million)

Well No.	Date Analyzed	Depth of Well (feet)	Turbidity	Color	Odor	Temperature (°F)	Total Solids	Total Hardness ($CaCO_3$)	Alkalinity (P)	Alkalinity (M)	Calcium (Ca)	Magnesium (Mg)	Iron (Fe)	Carbon Dioxide (CO_2)	pH	Fluoride (F)	Chloride (Cl)	(Sodium (NA) & (Potassium (K) (Calculated as (Sodium	Silica (SiO_2)	Sulfate (SO_4)
1	1-30-59	1446	<2	80	-	-	1937.72	0	-	1480	0	0	0	40.5	7.9	0	220	823.76	5.6	0
2	11-24-64	756	<2	<5	-	81	273.95	0	14	208	0	0	0	0	8.4	0	11	115.20	2.0	12.50
3	10-22-62	768	<2	-	-	-	249.06	4.8	28	213	1.92	0	0	0	8.8	-	6	100.97	3.4	8.39
4	6-10-55	803	<2	10	-	-	217.13	0	12	163	0	0	0	0	8.6	0	7	80.93	-	2.96
5	9-24-63	924	<2	0	H_2S*	85	289.09	0	22	173	0	-	0	0	8.8	0	4	104.84	2.0	26.17
6	10-22-62	1000	<2	-	H_2S	86.5	233.07	0	4	193	0	0	0	0	8.8	0.4	2	96.83	5.6	10.21
7	10-27-64	1502	<2	50	None	-	272.28	0	20	205	0	0	0.4	0	9.0	0.2	11	113.70	6.0	6.58
8	7-17-60	637	<2	-	H_2S	-	314.98	15.4	0	232	3.45	1.65	0.1	-	8.1	0.2	14	121.35	8.4	26.00
9	8-31-61	724	<2	-	H_2S*	80	449.78	93.2	-	226	22.12	9.23	0.3	12	7.6	0.2	36	133.17	10.0	102.55
10	10-29-58	786	<2	-	-	-	396.48	0	-	218	0	0	0.54	30	7.2	0	30	149.92	-	63.00
11	12-11-59	1034	<5	50	H_2S	-	354.87	8.8	8.0	240	3.53	Trace	0.15	0	8.4	0.4	27	141.91	1.6	34.24
12	1-3-61	1106	<2	140	-	-	512.71	0	28	320	0	0	0	0	8.4	0.6	69	212.75	19.2	16.62
13	9-4-63	1150	-	240	-	-	459.03	0	20	375	0	0	Trace	-	8.5	0.5	20	194.73	19.2	0
14	8-5-59	1175	<2	55	None	-	397.54	3.6	20	234	0.14	0	0.1	0	8.4	0.4	27	158.93	10.8	41.81
15	5-22-61	473	<2	-	-	-	363.76	0	30	294	0	0	0	0	8.6	-	8	159.16	9.2	10.21
16	8-4-64	148	<2	<5	H_2S*	66.5	-	79.0	0	306	14.26	10.55	0.2	27	7.4	-	130	-	-	-
17	8-25-59	240	<2	0	-	-	297.85	9.6	0	196	2.25	0.59	0.4	21	7.3	0.3	14	90.39	26.8	55.47
18	8-5-59	298	<2	10	-	-	347.0	23.0	-	203	5.00	1.21	0.5	2	7.8	0.6	16	121.21	26.8	53.83

*Only slight odor.

(SEE TABLE 2 FOR OTHER DATA)

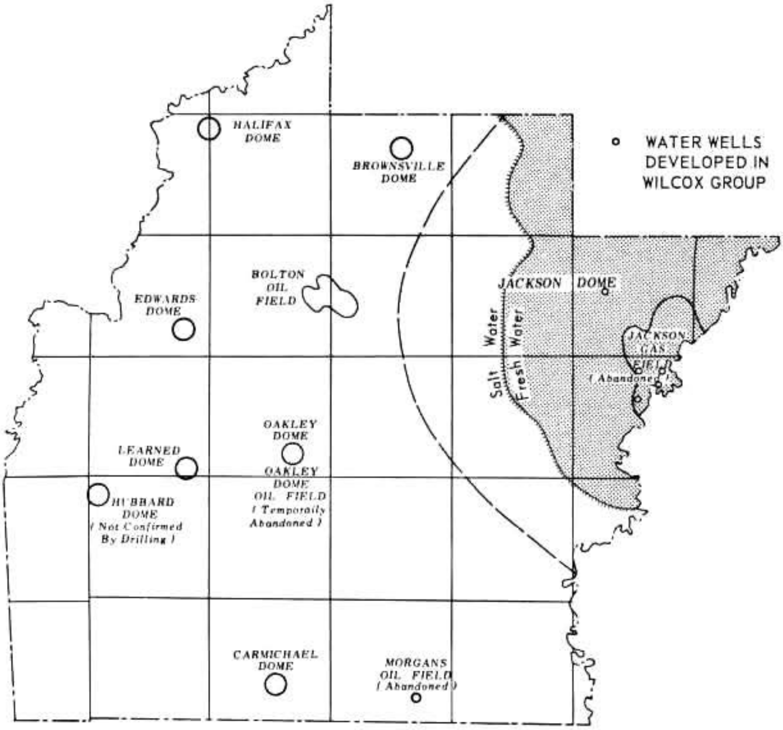

Figure 2.—Limits of fresh-water bearing sands in the Wilcox group as determined from electrical logs.

WILCOX GROUP

The Wilcox group is present beneath all of Hinds County, but its importance as a source of ground water is limited to the Jackson Dome area. Figure 2 shows the limits of the fresh-water bearing sands as determined from electrical logs. The Wilcox consists chiefly of irregularly bedded shale, silt, sand and lignite. The group is about 1,150 feet thick on the crest of the Dome, thickening to over 1,500 feet on the flanks within the potential productive area. Only the sands developed in the upper part of the section contain fresh water; those in the middle and lower parts contain salty water. Northward and eastward from the Jackson Dome successively lower sands in the Wilcox contain fresh water.

At the top of the Wilcox there is a persistent sand of varying thickness. Below this bed, the sands are more or less lenticular and do not allow satisfactory correlations between wells. The sands range from fine-grained to coarse-grained. Aggregate thicknesses of water sand in wells range from less than 50 feet to over 300 feet. Individual beds range from a few feet up to as much as 200 feet thick. The few analyses available indicate that there is much variation in the quality of Wilcox water. In general, the water is soft, colored, and moderate to high in total solids.

Relatively few wells have been developed in the Wilcox group. Consequently, not much is known as to the actual potential of this aquifer. For many years, the King Edward Hotel at Jackson has used water from a well developed in the Wilcox at a depth of 1,446 feet. Wells to be drilled to test all of the productive horizons must be 1,150 to 2,450 feet deep depending on their location with respect to the Jackson Dome. Plate 2 (Bicker) is a structure map constructed with the top of the Wilcox as datum.

KOSCIUSKO FORMATION

The Kosciusko (Sparta) formation is in the subsurface in all of Hinds County. The formation consists chiefly of irregullarly bedded sand, silt, clay and lignite. Sand is predominant with the silt-clay facies developed as lenticular bodies. Sands are most persistent in the middle part of the unit, but those developed in the lower and upper parts are prominent locally. The formation is about 400 feet thick on the crest of the Jackson Dome, thickening downdip to over 800 feet in southwestern Hinds County.

The sands range from fine-grained to coarse-grained, but they are more commonly fine- to medium-grained. Aggregate thicknesses of water sands in wells range from less than 50 feet to over 400 feet (Plate 1). Individual beds range from a few feet up to 250 feet thick. The water from the Kosciusko is generally of good quality. It is soft, clear and low to moderate in total solids. At a few places iron content is high. Locally the water is colored because of an abundance of lignite or lignitic matter in the sands or in the associated silt and clay beds.

Most wells producing from the Kosciusko formation are in the area of the Jackson Dome where the aquifer is at moderate depths. These wells provide water for suburban public supplies, industries, hotels and office buildings around Jackson. Recently Clinton expanded its municipal supply by the addition of wells producing from the Kosciusko at depths of about 1,000 feet. Wells developed in the Kosciusko range from 600 to 1,500 feet deep. The potential of the aquifer is much greater than its present development. Electrical logs indicate that there is fresh water in the formation throughout Hinds County to 2,000 feet or possibly deeper.

COCKFIELD FORMATION

The entire Cockfield formation underlies Hinds County, except in the small area at the crest of the Jackson Dome where the uppermost part is at the surface (Plate 2). The formation consists chiefly of irregularly bedded sand, silt, clay and lignite. Sand is predominant with the silt-clay facies developed as lenticular bodies. Sands are most persistent in the lower part, but those in the middle and upper parts are well-developed locally. The formation is about 250 feet thick on the crest of the Jackson Dome, thickening downdip to over 600 feet in the western and southwestern parts of the County.

The sands range from very fine-grained to medium-grained, but they are more commonly fine-grained. Aggregate thicknesses of water sand in wells range from less than 50 feet to as much as 300 feet (Plate 2). Individual beds range from a few feet to as much as 250 feet thick. The water from the Cockfield is soft to moderately hard. It is moderate to high in total solids and is locally high in iron and fluoride. The water is variably colored depending on the local abundance of lignite in the sediments. The color in the water characteristically increases with depth.

The Cockfield provides a source of water for many domestic wells scattered over the County. Public supplies in Clinton, Pocahontas, Bolton, Edwards, Learned and Raymond are derived from the formation. These wells are from about 700 to 1,200 feet deep. There are also several wells in the Jackson Dome area that provide water for suburban public supplies around Jackson and for small industries. Wells producing from the Cockfield range from 200 to 1,400 feet deep.

FOREST HILL FORMATION

The Forest Hill formation underlies about two-thirds of Hinds County west and south of the Jackson Dome area (Plate 3). The formation consists chiefly of irregularly bedded clay, silt, sand and lignite. The finer sediments are predominant. The sands are commonly present as relatively thin lenticular beds at various levels in the formation. The Forest Hill is commonly 80 to 100 feet thick, but at some places it is as much as 220 feet thick. Where the thicker sections are present, there is generally a well-developed basal sand.

The sands range from very fine-grained to medium-grained, but they are mostly fine-grained. Aggregate thicknesses of water sand in wells range from less than 20 feet to over 140 feet (Plate 3). Individual beds commonly are less than 15 feet thick, but sands as much as 175 feet thick are present locally. The water from the Forest Hill is soft to moderately hard and low to moderate in total solids. At places iron and fluoride contents are high. The water is variably colored because of the abundance of lignite in the sediments. This color characteristically increases with depth.

The Forest Hill is the source of water for many small diameter domestic wells in the area west and south of its outcrop limits. The public supply at Terry is derived from this aquifer from wells about 500 feet deep. Wells producing from the Forest Hill range from less than 50 to over 650 feet deep.

CATAHOULA FORMATION

The Catahoula formation is at the surface and in the shallow subsurface over the southern half of Hinds County (Plate 4). There are outliers north of this area but they are insignificant as a source of ground water. The formation consists chiefly of irregularly bedded sand, silt, clay, sandstone and siltstone. The sands are commonly present as lenticular beds at varying levels in the formation. However, a well-developed basal sand is present locally. Only the lower 500 feet of the Catahoula are present in the County.

The sands range from fine-grained to coarse-grained, but the fine-grained and fine- to medium-grained sizes predominate. Aggregate thicknesses of water sand in wells range from less than 20 feet to as much as 140 feet (Plate 4). Individual beds range from a few feet to 100 feet thick. The water from the Catahoula is generally of good quality. It is soft to moderately hard and low to moderate in total solids, but is commonly high in iron content.

The Catahoula formation is a source of water for many small diameter domestic wells in the southern part of the County. The public supply at Utica is derived from this aquifer from wells between 200 and 300 feet deep. Wells producing from the Catahoula range from less than 50 feet to over 350 feet deep.

EXPLANATION OF MAPS

Plates 1, 2, 3 and 4 are isopachous maps showing the net thicknesses of fresh-water sands in the Kosciusko, Cockfield, Forest Hill and Catahoula formations, respectively. Data used in their construction were obtained from electrical logs of water wells, core holes and oil test wells. Several hundred logs were available for studies of the Forest Hill and Catahoula formations inasmuch as many of the borings penetrated to depths below these shallow aquifers. Consequently, the isopachous maps of the Forest Hill and Catahoula sands have good control because of the number and distribution of the logs. The studies of the deeper Kosciusko and Cockfield formations are based largely on the electrical logs of oil test wells. Only those logs that showed the entire thickness of the respective units were used. Even though there have been oil test wells drilled in many parts of the County, the number of logs available for study of the Kosciusko and Cockfield was small as compared to the number available for study of the shallower aquifers.

In order to select producible sands from the electrical logs, it was necessary to establish minimum limits of thickness and resistivity. A study of the records of shallow domestic water wells showed that successful completions are made in sands as thin as five feet. It is doubtful that thinner sands would sustain water production for any length of time. Therefore, only those sands five feet or more in thickness were considered producible. The resistivity measurements recorded on electrical logs give some indication of the permeability of the sediments and of the nature of the contained fluids. Permeability is the capacity of a rock to transmit fluids. The more permeable rocks containing fresh water have high resistivity values. A comparison of the electrical logs showed that most of the known fresh-water producing sands in the County have resistivity values greater than 10 ohms. Therefore, only those sands having resistivity values of 10 ohms or more were considered producible.

Each electrical log was analyzed to determine the thickness of fresh-water sands in a particular well. The total of the thicknesses is the net or aggregate thickness and represents the numerical value assigned to a well. Only those wells that provide control data are shown on the individual maps. In constructing the isopachous maps, the values assigned to the wells were contoured, and the resulting map shows lines of equal net sand thickness.

In order to estimate the volume of fresh water contained in the aquifers, calculations of acre-feet for the sands shown on each isopachous map were made with the aid of the compensating polar planimeter. This instrument makes accurate measurements of plane acres from the map. The method of calculating the acre-feet of an area enclosed by two contours was to multiply the number of acres by the average thickness between the higher value contour and the lower. For example, the area between an 80 and 60 foot contour is 200 acres. The 200 acres multiplied by 70 would be the number of acre-feet for the area. This procedure was used for each area enclosed by successively lower value contours. In making these calculations, the number of acres determined by planimetry differed from the accepted figure for the total number of acres in the County. This difference divided by the total number of acres indicates the accuracy of the planimetry. The percentage of accuracy of each survey is shown in Table 1. To estimate the volume of water in each aquifer it was necessary to determine what portion of the sand represents reservoir space. An assumed value of 30 percent porosity is used. This figure is probably conservative inasmuch as porosities in these sands range from about 25 to 40 percent. Acre-feet of reservoir is obtained by multiplying the acre-feet of sand by the percent porosity. The reservoir space was then multiplied by the number of gallons per acre-foot to determine the volume of water in the sand. The estimated volume of water for each aquifer is shown in Table 1.

Plates 2 (Bicker), 3 (Bicker) and 4 (Bicker) are structure maps constructed on the tops of the Wilcox group, the Moodys Branch marl and the Glendon limestone, respectively. These tops are the most reliable mapping horizons in the shallow subsurface formations. Structure contour maps on the tops or bottoms of the formations that contain fresh-water sands would be most useful in making ground water interpretations. However, the upper and lower boundaries of most of these formations in the County are irregular or not easily recognizable on electrical logs. The structure maps show the major structural features and local deviations from the regional dip. They are useful in predicting the depth to which a well must be drilled in order to penetrate the formations containing fresh-water sands. Of course, an understanding of the stratigraphic positions and thicknesses of the formations is essential. Plate 3 (Moore) is a stratigraphic-structure cross-section along a line from the crest of the Jackson Dome to the southwestern part of Hinds County. This section shows the stratigraphic relationships of the formations and their relative thicknesses across the County.

SURFACE WATER RESOURCES

The surface waters of Hinds County include the many streams, lakes, ponds and springs. These sources provide water for recreational activities, human and livestock consumption, sewage and industrial waste disposal and irrigation purposes. Only the major streams and impounded waters are described herein.

STREAMS

The major streams that provide a source of surface water for Hinds County are the Pearl River and the Big Black River. The Pearl River forms the eastern boundary of the County. At the gaging station near Jackson, the drainage area is approximately 3,100 square miles. Records of the U. S. Geological Survey show that the average daily discharge over 43 years (1901-12, 1928-60) was 3,770 cfs (cubic feet per second). During this period the minimum daily discharge was 78 cfs and the maximum was 80,800 cfs. For many years the Pearl River has provided a water supply for Jackson. The waterworks consists of a pumping station and a treatment plant located adjacent to Riverside Park. A low-head dam on the River diverts water to the pumping station. Treatment of the water is by coagulation with alum and lime and with carbon for taste and odor control and by sedimentation, rapid sand filtration, ammoniation and chlorination. The plant has a rated capacity of 37 million gallons of water per day. Finished water storage is three million gallons. The average amount of water used daily in the City water system is about 16 million gallons.

The Big Black River forms the western boundary of the County. At the gaging station near Bovina, Warren County, the drainage area is approximately 2,810 square miles. Records of the U. S. Geological Survey show that the average daily discharge over 24 years (1936-60) was 3,344 cfs. During this period the minimum daily discharge was 65 cfs and the maximum was 58,600 cfs.

IMPOUNDED WATERS

The major impounded waters that provide a source of surface water are the Ross Barnett Reservoir and Lake Hico. The Ross Barnett Reservoir includes parts of Hinds, Madison, Rankin, Scott, and Leake Counties (Figure 3). The water is obstructed by an earth dam across the Pearl River valley about three miles northeast of the Jackson city limits. At normal level and during low river flow, the lake consists of about 31,000 acres or 50 square miles and extends about 43 miles upstream from the spillway into Leake County. The permanent water level is 296 feet above sea level. The average depth of the lake is 10 feet, but it is as much as 50 feet deep near the dam. The Reservoir was constructed to provide a source of water supply and recreation.

According to the Lester Engineering Company and Harza Engineering Company, it is anticipated that the Reservoir will provide more than an adequate supply of water for Jackson through the year 2000. The usage of surface water from the Pearl River at Jackson is presently about 16 million gallons daily. Projected demand 40 years hence is estimated to be 100 million gallons per day. Reservoir drawdown of two feet will yield a minimum dry season supply of 186 million gallons per day, and a drawdown of three feet will yield 240 million gallons per day. This flow will provide ample water to meet the foreseeable needs of Jackson and still permit releases to downstream users. The City proposes to take water from the Reservoir through a pipeline leading to the treatment plant.

Lake Hico is located in north Jackson in Section 16, Township 6 North, Range 1 East. The Lake, covering about 360 acres, is irregular in shape but conforms somewhat to the boundaries

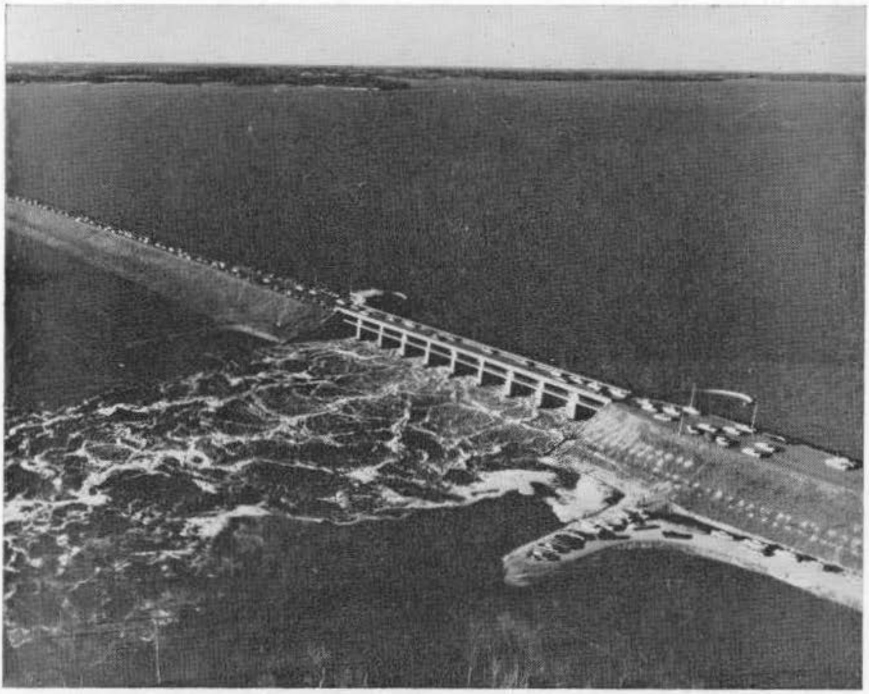

Figure 3.—The Ross Barnett Reservoir constructed for a source of water supply and recreation. Looking northwest. The water level first reached its normal stage of 296 feet above see level on January 1, 1965. Photo by Bob Hand, February 1965.

of the section. The water is impounded by an earth dam on the east, south and west sides. The water level is normally at 359 feet above sea level. The water filling the Lake is pumped by pipeline from the Pearl River. Lake Hico was constructed in order to provide a recreational facility for the Jackson area and to provide a source of water supply for the Mississippi Power & Light Company's steam generating plant located nearby.

ACKNOWLEDGMENTS

The Survey wishes to express its sincere gratitude to the numerous oil companies which donated many electrical logs of core holes drilled in exploration for oil and gas. This information was of inestimable value in constructing the isopachous and structure maps and in the study of the ground-water aquifers. Acknowledgments are due Mr. J. W. Lang of the U. S. Geological Survey for electrical logs and samples from water wells, Mr. J. E. Johnson and Mr. J. C. McDonald of the Mississippi State Board of Health for analyses of water samples, and Mr. Eugene Thomas of the Pearl River Valley Water Supply District for information concerning the Ross Barnett Reservoir.

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HINDS COUNTY CLAY TESTS

THOMAS E. McCUTCHEON

ABSTRACT AND INTRODUCTION

Twenty-two clay samples collected by the Survey were tested for their general ceramic characteristics at the Georgia Institute of Technology Ceramic School of Engineering under the surveillance of Dr. Lane Mitchell and by the writer, under methods prescribed by the American Ceramic Society.

Chemical analyses of the samples were made by the Shilstone Testing Laboratory and are presented in this part of the report with comments.

The physical portion of the screen analyses was made by the writer and the description of the residue is by William H. Moore.

The test data is given here as to the chemical analyses, Table 1 and Figure 1, and as to the screen analyses, Table 2. The ceramic test data is shown under Tables 3 and 4. In these latter tables, the various clays have been subdivided as to their geologic formations and further subdivided into groups representing their physical characteristics. Comments and possibilities for utilization of the clays are given.

COMMENTS ON DATA AND POSSIBILITIES FOR UTILIZATION

YAZOO CLAY

The upper part of the clay represented by sample AF-40, 8.5-26′ is different from the middle and lower portions represented by samples AF-40, 26-40.5′ and 40.5-50′ inasmuch as it contains less lime (CaO) (see chemical analyses, Table 1 and Figure 1). The screen analyses of the three layers, top to bottom, average less than 2% residue on 250 mesh and indicate no significant difference in the course of mineral content. Qualitative chemical analyses indicate no lime as the carbonate present in the upper portion of the clay but considerable in the middle and lower strata. The plastic and drying properties of the samples from the whole section are very much alike. On burning, the upper layer of the clay tends to crack and the middle and lower portions tend to bloat. The middle and lower strata of the clay are carbonaceous.

The Yazoo clay is suited for the production of lightweight aggregate. The strata 26-50′ are very amenable to bloating at low temperatures and the stratum 8.5-26′ could be used if properly blended to control bloating characteristics.

Due to the high drying and burning shrinkage and the tendency to bloat and crack on burning, the clay is not suited for the usual variety of heavy clay products.

BUCATUNNA CLAY

Two samples, AF-26, 8-21′ and AF-37, 2-60′, are generally alike in their plastic, drying and burning properties. Sample AF-26, 8-21′ contains more free quartz and is slightly higher in alumina content. Sample AF-37, 2-60′ is more carbonaceous. Both clays have a very high water of plasticity value and both are high in their linear drying shrinkage. Due to the tendency of the clay to crack on drying it was not possible to determine their dry strengths. This condition indicates the possibility of a rather high bonding strength when mixed with non-plastic clays and minerals. On burning, both clays tend to crack due to strains set up in drying. There is very little tendency for the clays to bloat under normal burning conditions.*

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*Cored Bucatunna clay from Hole AF-1A, 40-95′, was tested for making lightweight aggregate. This information was published in M.G.S. Bulletin 103 and is as follows:

"Clay AF-1A bloated extensively over a wide firing range. The resulting aggregate is strong and has an excellent bleb structure. Clays fired at 2200°F appear to be over-bloated as they are greenish-brown, vitreous, have large pores and are extremely brittle. This clay appears to be an excellent potential raw material for the production of lightweight aggregate." (Allan G. Wehr)

The sample from AF-1A was fired in the rotary kiln of the Norris Metallurgy Research Laboratory with the following results:

	AF-1A (40-95′)
Crushing Characteristics	Good
Particle type and shape	Angular
Thickness	Non-uniform
Uniformity	Unweathered
Screen Analysis of Raw Material	
—1 + 3/4	.6
—3/4 + 1/2	11.5
—1/2 + 3/8	17.4
—3/8 + 1/4	33.3
—1/4 + 1/8	17.2
—1/8	20.0
Size Used in Rotary Kiln	
—3/4 + 1/2	18.5
—1/2 + 3/8	27.9
—3/8 + 1/4	53.6

Kiln Wall and Particle Temp. °F			Kiln wall	Particle
Minimum			1900	1950
Optimum			1950	2020
Maximum			1960	2040
Retention time (Min.)				15
Weight unfired Lb/Ft^3				69.7
Weight fired Lb/Ft^3				30.0
Processing characteristics				Good
Material flow				Uniform
Point of material release				10.00
Particle Shape			Angular	
Pore Structure				
Coarse, medium, fine			Fine	
Expansion			Good	
Uniformity of firing			Uniform	
Color			Light-brown	

Sizes	Asg.	Lb/Ft^3	%Abs.
—3/4 + 1/2	0.75	46.7	2.8
—1/2 + 3/8	0.84	52.3	3.0
—3/8 + 1/4	0.86	53.6	2.9

Screen Analysis of Fired Material	
—3/8	27.7
—3/8 + 1/4	48.1
—1/4 + 8	19.1
—8	5.1
Bags Cement 5/yd - Autoclave Cure	
Bulk Sp. Gr.	2.13
Lb/Ft^3	78
Compression (psi)	3659
% Abs.	2.27
Bags Cement 7/yd - Autoclave Cure	
Bulk Sp. Gr.	2.20
Lb/Ft^3	77
Compression (psi)	4220
% Abs.	2.30
Bags Cement 5/yd - 28-Day Cure	
Bulk Sp. Gr.	1.09
Lb/Ft^3	68
Compression (psi)	2300
% Abs.	3.60
Bags Cement 7/yd - 28-Day Cure	
Bulk Sp. Gr.	1.11
Lb/Ft^3	69
Compression (psi)	2854
% Abs.	4.02

The resistance of the aggregate to disintegration by saturation solutions of magnesium sulfate was determined by means of the standard ASTM Soundness Test. The results of this test are as follows:

Aggregate	Retained on Sieve No.	Precent Loss (By Weight)
AF-1A	4	2.8
	8	2.4
	16	5.2
	30	2.2
	50	2.4

Further information on testing of this sample can be found in Bulletin 103.

TABLE 1

CHEMICAL ANALYSES OF CLAYS
HINDS COUNTY, MISSISSIPPI
SHILSTONE TESTING LABORATORY, ANALYST
No. 1362, January 26, 1965

Sample No.	Geologic Unit	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Na_2O	K_2O	SO_3	P_2O_5	Ign.	Total
AF-26 (8-21)	Bucatunna	64.60	19.04	6.15	0.96	1.84	0.17	0.51	0.30	0.09	6.12	99.78
AF-27 (0-20)	Catahoula	73.50	14.74	4.14	0.55	0.79	0.17	0.60	Trace	0.08	4.50	99.07
AF-28 (2-27)	Catahoula	73.51	15.99	4.78	0.47	0.65	0.11	0.48	Trace	0.05	4.71	100.75
AF-29 (6-29)	Catahoula	74.41	16.46	3.00	0.68	0.61	0.08	0.35	0.03	0.05	4.28	99.95
AF-30 (1-32)	Catahoula	81.19	9.72	4.08	0.62	0.51	0.30	0.65	0.02	0.06	3.36	100.51
AF-31 (2-20)	Terrace clay	77.23	13.26	4.03	0.46	0.66	0.05	0.43	Trace	0.05	3.92	100.09
AF-32 (22-30)	Catahoula	70.31	17.45	3.93	0.93	1.00	0.14	0.40	0.03	0.04	5.89	100.12
AF-33 (8-23)	Catahoula	73.99	15.85	4.48	0.32	0.62	0.07	0.47	0.03	0.05	4.80	100.68
AF-34 (4-26)	Catahoula	67.61	17.50	5.86	0.43	1.03	0.16	0.22	0.07	0.14	5.52	98.54
AF-35 (2-12)	Catahoula	76.13	14.78	3.92	0.42	0.69	0.05	0.03	0.14	0.04	4.60	100.80
AF-37 (2-60)	Bucatunna	63.62	17.70	6.10	0.43	1.87	0.14	0.42	0.95	0.12	7.99	99.34
AF-40 (8.5-26)	Yazoo	59.60	20.82	6.26	0.12	1.77	0.09	0.78	1.52	0.13	8.57	99.66
AF-40 (26-40.5)	Yazoo	52.20	18.14	6.61	7.47	1.79	0.10	0.75	0.64	0.12	9.19	97.01
AF-40 (40.5-50)	Yazoo	53.62	19.56	6.22	5.72	2.14	0.09	0.92	0.22	0.11	9.12	97.72
AF-41 (0-14)	Loess	79.46	10.07	3.75	0.37	0.62	1.02	1.51	0.06	0.15	2.27	99.28
AF-42 (0-17)	Loess	78.65	10.53	3.85	0.45	0.78	0.91	1.55	0.12	0.16	2.65	99.65
AF-43 (0-21)	Loess	77.99	11.07	3.86	0.43	0.82	0.95	1.44	0.06	0.13	2.56	99.31
AF-44 (1-18)	Loess	82.36	8.64	2.61	0.33	0.6[illegible]	0.88	1.31	0.04	0.12	2.02	98.93
AF-45 (1-15)	Loess	79.51	10.48	3.38	0.06	0.94	0.77	1.07	0.02	0.11	2.63	98.97
AF-46 (2-13)	Catahoula	78.56	12.75	2.55	0.08	0.31	0.05	0.06	0.10	0.04	4.31	98.81
AF-47 (17-32)	Catahoula	77.24	11.34	3.23	0.17	0.76	0.16	0.53	0.15	0.05	3.59	97.22
AF-48 (6-24)	Catahoula	76.13	12.41	3.81	0.21	0.68	0.21	0.55	0.01	0.06	3.86	97.93

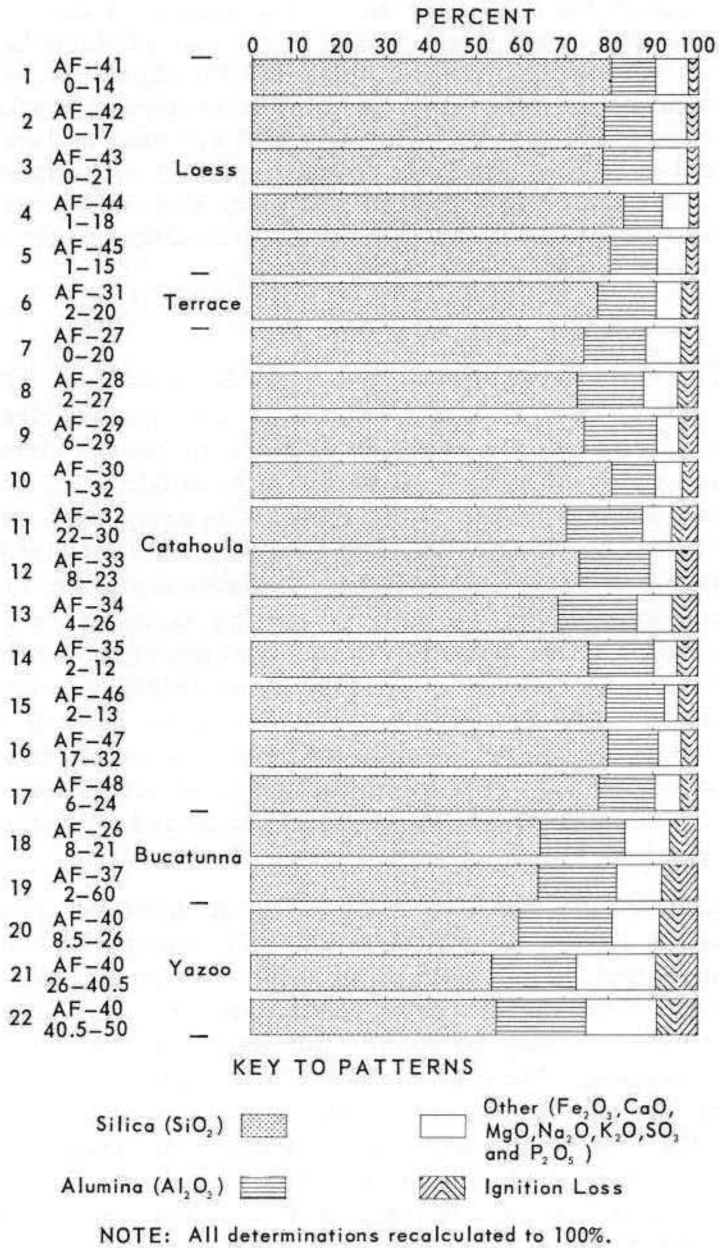

Figure 1.—Plotted chemical analyses (recalculated to 100%) of the 22 Hinds County clay samples tested. See data, Table 1.

Although the clays have little value when used alone, they could be used in the production of heavy clay products in the order of ten to fifteen percent to increase the plastic and working properties of such relatively non-plastic clays as the loess. The clays are similar to bond clays that are used as bonding material in foundry sands. In foundry use they also appear to be suitable as a bond with more refractory clays and grogs for use in ladle linings. They also have a possibility for use as a drilling mud.

CATAHOULA CLAY, GROUP 1

The three clays, AF-32, 22-30′, AF-33, 8-23′ and AF-34, 4-26′, are grouped as a unit because of their general ceramic characteristics and the apparent tendency to show a stain on burning which could be from soluble iron sulfate. Chemically the clays are very similar in their composition except for variable quantities of free quartz. The clays have very excellent plasticity and extrusion properties. They have excessive drying shrinkage and unusually high dry strength. On burning, there is a tendency for the clays to crack. However, some test specimens exhibited very high burned strengths. The total linear shrinkage on drying and burning averages between nine and eleven percent. The fired colors, except for staining, are very light red at cone 02 and darken with increase of temperature to attractive shades of red. The clays have a very long burning range and are not overburned at cone 11.

The clays could be used in heavy clay products manufacture should the staining be controlled by small additions of barium carbonate and lightly calcined to reduce excessive shrinkage. A portion of the clay in a brick or tile body could be preburned and reduced to grog to control shrinkage and the tendency toward cracking. The clays have excellent possibilities as bonding clay for use in connection with relatively non-plastic clays and silts. They would improve the working properties of the loess clay when used in relatively small quantities. They have possibilities as a bond in foundry sand* and when used in small quantities, as a bond in medium duty refractories.

*See discussion of bond clay testing in the section by Moore.

CATAHOULA CLAY, GROUP 2

The three clays in this group, AF-27, 0-20′, AF-28, 2-27′ and AF-29, 6-29′, are very similar to the Catahoula clays in Group 1 except that they are clean burning and show no tendency toward staining. The colors are very attractive, light-red to medium-red with a tendency toward gray at cone 11.

The possibilities are the same as given for the Group 1 clays but will be more desirable.

CATAHOULA CLAY, GROUP 3

The third group of Catahoula clays consists of samples AF-30, 1-32′, AF-31, 2-20′ and AF-35, 2-12′. They are more siliceous than the clays in Groups 1 and 2. They burn to very attractive shades of light-red to medium-red and have a long maturing range with very little alteration in burning shrinkage. The clays are very plastic and have very high dry strength. Most of the total shrinkage is in drying. However, the total overall shrinkage after burning is about normal for clays used in the heavy clay products industry. Although there is a considerable variation in the free quartz content it is not reflected to the same extent in the total silica content as determined by chemical analyses. These indicate that the clays contain a considerable percent of free quartz finer than that retained on a 250 mesh screen. On slow drying the clays warp slightly but do not crack. If used alone in the manufacture of brick and tile it would be necessary for the product to be dried under rigidly controlled conditions.

The clays have possibilities for use for such products as face brick, structural tile, conduit and drain tile. In these instances the clay should be lightly calcined to reduce drying shrinkage and speed up the drying cycle. A portion of the clay could be preburned and reduced to grog to aid in the drying process. The admixture of grog to the clay would allow varied texture possibilities for face brick. The clays could be used also in a blend with the loess to produce excellent brick and tile products. A blend with the loess would eliminate the need of calcining for use of the clays in structural tile, conduit and drain tile. This same mixture has excellent possibilities for the manufacture of flower pots and garden pottery.

CATAHOULA CLAY, GROUP 4

Group 4 of the Catahoula clays, consisting of samples AF-46, 2-13′, AF-47, 17-34′ and AF-48, 6-24′, represents clays containing higher percentages of quartz than the three preceding groups. Although there is an apparent wide variation in the free quartz content as retained on the 250 mesh screen, there is only about two percent difference in the silica content as determined by chemical analyses and approximately one percent difference in the alumina content of the three samples. Ceramically, the clays are characterized by a fairly high drying shrinkage, a very low burning shrinkage, good plastic and drying properties and excellent dry strength. On burning, the colors are fairly uniform between cones 2 and 7½ in a range of light- to medium-red. At cone 11 the color is reddish-brown to grayish-buff. The clays have a long firing range with little alteration between cones 02 and 11. The porosity and absorption values of these clays are fairly high but within the limits of most heavy clay products.

The clays in this group are complete in themselves for the manufacture of common brick, face brick, drain tile and fireproofing. The clay from test hole AF-46 contains too much free quartz to allow adequate fired strength for face brick manufacture. Too much free quartz in a clay mixture tends to weaken its structure due to the expansion and contraction of the uncombined quartz during the burning and cooling cycles. The clay from test hole AF-48 is the most desirable clay in this group for heavy clay products manufacture. This clay is also suitable for the manufacture of flower pots and garden pottery.

LOESS CLAY

Loess is commonly referred to in some circles as a silt, but with those who manufacture it into usable structural products it is commonly known as the loess clay. Although the major ingredient in the loess is a very fine silt, some is plastic enough to be extruded into such products as brick. The loess in this report refers to samples taken from test holes AF-41, AF-42, AF-43, AF-44 and AF-45. The loess from test holes AF-42 and AF-43 average less than one and one-half percent residue on a 250 mesh screen. The residue is largely quartz. The other three samples show slightly increasing amounts of free quartz which is not necessarily associated with the original deposition. The typical uncontaminated loess ranges in its composition from seventy-eight to seventy-nine percent silica, from ten to eleven percent alumina and approximately three and three-quarters percent iron. The loess has a type of false plasticity in a very short working range. This is probably due to the fineness of the silt rather than plasticity developed from hydrosilicates of aluminum as present in the usual type of clay. It is believed that the alumina content of the loess is combined with other minerals such as silica in a non-hydrous form (as feldspar or mica) inasmuch as chemical analyses indicate over two percent sodium and potassium oxides.

Some deposits of loess are plastic enough to be extruded and manufactured into brick. With others it is necessary to add plastic clays to develop a working composition. Sample AF-45, 1-15′ is plastic enough to be used alone in the manufacture of brick but its working properties would be improved by the addition of plastic clay. The loess from test holes AF-41, AF-42, AF-43 and AF-44 will require the addition of plastic clay in the range of ten to twenty percent to make satisfactory heavy clay products. The clays mentioned under the Catahoula Groups 1, 2 and 3 would be satisfactory for this purpose. The loess, having very low drying and burning shrinkage, is very easily dried and burned, and on burning, develops into beautiful shades of red at cone 02 and is not overburned at cone 7½. This property allows the loess to be used in the manufacture of excellent brick, and if sufficient plastic clay is added it could be made into structural tile and face brick. Garden pottery and flower pots are possible products when using sufficient plastic clay.

Table 2

SCREEN ANALYSIS

TEST HOLE AF-26 8 TO 21 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	1.2	Quartz (A) limonite (C) limonitic clay (C)
100	3.2	Quartz (A) limonite (C) limonitic clay (C) heavy minerals (T)
250	2.0	Quartz (A) limonite (C) limonitic clay (C) heavy minerals (T)
PAN	93.6	Clay (A) silt (S)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-27 0 TO 20 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	0.1	Limonite (A) quartz (C) clay (C) organic material (T)
100	0.4	Quartz (A) limonite (C) clay (C) kaolinite xls. (S) organic material (T)
250	2.4	Quartz (A) limonite (C) clay (C) muscovite mica (T) glauconite (T)
PAN	97.1	Clay (A) silt (C)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-28, 2 TO 27 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	Tr	Clay nodules (A) limonite (C) lignite (C) lime nodules (S) quartz (T) kaolinite crystals (T)
100	0.1	Clay (C) quartz (C) limonite (C) lime nodule (S) kaolinite crystals (T) selenite (T)
250	4.0	Quartz (A) clay (S) limonite (S) lignite (S) selenite (T) kaolinite crystals (T)
PAN	95.9	Clay (A) silt (S) lignite (S)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-29 6 TO 29 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	Tr	Quartz (A) clay (C) limonite (C) organic material (S)
100	1.1	Quartz (A) limonite (S) clay (S) heavy minerals (T)
250	6.4	Quartz (A) clay (S) heavy minerals (T)
PAN	92.5	Clay (A) silt (C)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-30 1 TO 32 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.1	
60	Tr	Quartz (A) lignite (C) pyrite (S) limonite (S) clay (S)
100	Tr	Quartz (A) clay (S) lignite (S) pyrite (S) limonite (S)
250	13.0	Quartz (A) clay (T) lignite (T) muscovite mica (T)
PAN	87.0	Silt (A) clay (C)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-31 2 TO 20 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	0.3	Quartz (A) chert (C) limonite (C) organic material (T)
100	0.2	Quartz (A) chert (C) limonite (C) hematitic & limonitic clay (C)
250	14.3	Quartz (A) clay (T) organic material (T)
PAN	85.2	Clay (A) silt (C)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-32 22 TO 30 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	0.2	Clay nodules (A) quartz (C) pyrite (C) limonite (S) organic material (T)
100	0.8	Clay (A) quartz (C) pyrite (S) limonite (S)
250	8.6	Clay (A) quartz (C) pyrite (T)
PAN	90.4	Clay (A) silt (C)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-33 8 TO 23 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	0.7	Quartz (A) clay (C) limonite (C) organic material (T)
100	2.0	Quartz (A) clay (C) limonite (C) lignite (T) heavy minerals (T) kaolinite crystals (T)
250	6.5	Quartz (A) limonite (S) clay (S) lignite (T)
PAN	89.8	Clay (A) silt (C)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-34 4 TO 26 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	0.2	Limonite (A) clay (C) quartz (S)
100	0.6	Quartz (A) clay (C) limonite (C) lignite (T)
250	1.4	Quartz (A) clay (C) limonite (C) lignite (S)
PAN	97.8	Clay (A) silt (S)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-35 2 TO 12 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	Tr	Limonite (A) clay (C) quartz (C) organic material (C)
100	0.3	Quartz (A) clay (C) limonite (C) organic material (S)
250	7.6	Quartz (A) stained with limonite in part; clay (S) organic material (S) muscovite mica (T)
PAN	92.1	Clay (A) silt (C)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-37 2 TO 60 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.1	
60	Tr	Selenite (C) limonite (C) quartz (C) pyrite (S) organic material (C)
100	0.2	Quartz (A) limonite (C) pyrite (C) selenite (C) clay (S) organic material (T)
250	2.0	Clay (A) quartz (S) pyrite (S) selenite (S) organic material (S) glauconite (T)
PAN	97.8	Clay (A) silt (S) selenite (S)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-40 8.5 TO 26 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	0.6	Limonite (C) selenite (C) quartz (C) clay (S)
100	0.5	Limonite (C) selenite (C) quartz (S) clay (S)
250	0.8	Quartz (A) limonite (C) selenite (C) clay (S)
PAN	98.1	Clay (A) silt (S) selenite (T)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-40 40.5 TO 50 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	Tr	Pyrite (A) quartz (C) fossil fragments (C)
100	Tr	Pyrite (A) foraminifera and fragments of larger fossils (C) quartz (S) limonite (S)
250	0.4	Foraminifera and fragments of larger fossils (A) quartz (C) pyrite (C) organic material (S) muscovite mica (T)
PAN	99.6	Clay (A) selenite (T) foraminifera fragments (T)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-42   0 TO 17 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	Tr	Quartz (A) limonite (C) manganiferous in part; organic material (T)
100	0.2	Quartz (A) limonite (C) lignite (S) selenite (S) organic material (T)
250	1.0	Quartz (A) limonite (C) lignite (S) muscovite (S) pyrite (T) selenite (T)
PAN	98.8	Silt (A) lignite (S) clay (S)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-43 0 TO 21 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	0.4	Limonite (A) manganiferous material (C) quartz (C) clay (C) lime nodules (S) muscovite mica (T)
100	0.4	Quartz (A) limonite (C) manganiferous material (C) clay (C) lime nodules (T) muscovite mica (T)
250	0.7	Quartz (A) limonite (C) manganiferous material (C) clay (C)
PAN	98.5	Silt (A) clay (C) limonite (T)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-44 1 TO 18 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	0.8	Quartz (A) organic material (C) manganiferous material (S)
100	4.0	Quartz (A) manganiferous material (S) organic material (T)
250	6.4	Quartz (A) manganiferous material (S) organic material (T)
PAN	88.8	Silt (A) clay (S)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-45 1 TO 15 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	Tr	Quartz (A) limonite (C) manganiferous material (C) lime nodules (S) organic material (T)
100	1.4	Quartz (A) limonite (C) manganiferous material (S) organic material (T) lime nodules (T)
250	6.4	Quartz (A) limonite (S) manganiferous material (S) organic material (T)
PAN	92.2	Silt (A) clay (S)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-46 2 TO 13 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	1.0	Quartz (A) organic material (S)
100	10.6	Quartz (A) heavy minerals (T)
250	23.2	Quartz (A) heavy minerals (T)
PAN	65.2	Clay (A) silt (C)

Table 2, Continued

SCREEN ANALYSIS

TEST HOLE AF-47 17 TO 32 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	Tr	Quartz (A) selenite (C) limonite (C) kaolinite (S) clay (S)
100	1.0	Quartz (A) selenite (S) limonite (S) kaolinite (S) heavy minerals (T)
250	10.6	Quartz (A) selenite (S) heavy minerals (T) kaolinite (T)
PAN	88.4	Clay (A) silt (C)

Table 2, Concluded

SCREEN ANALYSIS

TEST HOLE AF-48 6 TO 24 FEET

SIEVE SIZE (MESH)	PERCENT RETAINED	CHARACTER OF RESIDUE
20	0.0	
60	0.8	Quartz (A) limonite (C) selenite (C) lignite (S) clay (S) chert (T)
100	1.2	Quartz (A) limonite (S) lignite (S) clay (S) selenite (T) muscovite mica (T) heavy minerals (T)
250	10.6	Quartz (A) lignite (S) heavy minerals (T) limonite (T)
PAN	87.4	Clay (A) silt (C) heavy minerals (T)

Table 3

PHYSICAL PROPERTIES IN THE UNBURNED STATE

HOLE NO.	DEPTH	WATER OF PLASTICITY WET BASIS (PERCENT)	WATER OF PLASTICITY DRY BASIS (PERCENT)	LINEAR DRYING SHRINKAGE (PERCENT)	MODULUS OF RUPTURE lBS. SQ. IN.	PLASTICITY	EXTRUSION	WARPAGE	COLOR (DRY BAR)	REMARKS
					YAZOO					
AF 40	8.5-26'	27.4	38.8	9.0	----	Good	Good	Yes	Dark tan	No data cracked
AF 40	26-40.5'	25.6	36.2	9.5	----	Good	Good	Yes	Dark gray	No data cracked
AF 40	40.5-50'	27.5	36.0	8.0	----	Good	Good	Yes	Dark gray	No data cracked
					BUCATUNNA					
AF 26	8-21'	28.1	36.8	8.5	----	Fair-sticky	Fair-puffy	Yes	Olive gray	No data cracked
AF 37	2-60'	29.0	40.75	11.5	----	Good	Good	Yes	Dark gray	No data cracked
					CATAHOULA GROUP 1					
AF 32	22-30'	24.75	32.70	7.5	755	Good	Good	Yes	Light gray	
AF 33	8-23'	19.70	24.5	7.0	1120	Good	Good	Yes	Light gray	
AF 34	4-26'	19.75	24.4	6.5	913	Good	Good	Yes	Tan	
					CATAHOULA GROUP 2					
AF 27	0-20'	23.0	28.8	7.5	----	Good	Good	Yes	Light tan	No data cracked
AF 28	2-27'	22.3	28.8	7.5	----	Good	Good	Yes	Light tan	No data cracked
AF 29	6-29'	21.6	27.5	7.5	----	Good	Good	Yes	Light tan	No data cracked

Table 3, Concluded

PHYSICAL PROPERTIES IN THE UNBURNED STATE

HOLE NO.	DEPTH	WATER OF PLASTICITY WET BASIS (PERCENT)	WATER OF PLASTICITY DRY BASIS (PERCENT)	LINEAR DRYING SHRINKAGE (PERCENT)	MODULUS OF RUPTURE 1BS. SQ. IN.	PLASTICITY	EXTRUSION	WARPAGE	COLOR (DRY BAR)	REMARKS
					CATAHOULA GROUP 3					
AF 30	1-32'	18.3	21.5	7.5	900	Good	Good	Slight	Light tan	
AF 31	2-20'	15.6	18.5	6.5	951	Good	Good	Slight	Light reddish gray	
AF 35	2-12'	18.0	22.0	6.5	1120	Good	Good	Slight	Light tan	
					CATAHOULA GROUP 4					
AF 46	2-13'	15.20	17.90	6.0	636	Good	Good	None	Light gray	
AF 47	17-32'	15.95	19.25	7.5	800	Good	Good	None	Light gray	
AF 48	6-24'	16.20	19.40	6.0	555	Good	Good	None	Light gray	
					LOESS					
AF 41	0-14'	16.10	19.10	1.0	537	Weak	Poor	None	Light brown	
AF 42	0-17'	17.5	21.2	1.5	316	Weak	Fair	None	Light brown	
AF 43	0-21'	16.8	20.21	2.0	322	Weak	Poor	None	Light brown	
AF 44	1-18'	16.9	20.40	1.0	267	Weak	Poor	None	Light brown	
AF 45	1-15'	16.55	19.80	2.5	388	Fair	Good	None	Light brown	

Table 4

PYROPHYSICAL PROPERTIES

HOLE NO.	DEPTH	TEMPERATURE °F.	AT CONE	POROSITY (PERCENT)	ABSORPTION (PERCENT)	BULK SPECIFIC GRAVITY	APPARENT SPECIFIC GRAVITY	TOTAL LINEAR SHRINKAGE (PERCENT)	MODULUS OF RUPTURE IN IB./SQ. IN.	COLOR	REMARKS
						YAZOO					
AF 40	8.5-26'	2014-2194	02-6	----	----	----	----	----	----	Red	No data cracked
AF 40	26-40.5'	2014-2194	02-6	----	----	----	----	----	----	Red	No data bloated
AF 40	40.5-50'	2014-2194	02-6	----	----	----	----	----	----	Red	No data bloated
						BUCATUNNA					
AF 26	8-21'	2014-2194	02-6	----	----	----	----	----	----	Red	No data cracked
AF 37	2-60'	2014	02	24.8	14.70	1.71	2.28	----	----	Red	No data cracked
AF 37	2-60'	2088	2	23.6	14.10	1.67	2.19	----	----	Red	No data cracked
AF 37	2-60'	2134	4	26.3	16.50	1.60	2.17	----	----	Red	No data, cracked Bloated at Cone 11
						CATAHOULA GROUP 1					
AF 32	22-30'	2014	02	16.2	8.31	1.96	2.34	8.5	----	Salmon	No data, cracked stained
AF 32	22-30'	2088	2	14.0	6.90	2.02	2.35	9.0	----	Light red	No data, cracked stained
AF 32	22-30'	2134	4	----	----	----	----	10.5	----	Light red	No data, cracked stained
AF 32	22-30'	2230	7.5	14.15	7.04	2.02	2.35	11.5	1800	Light red	Cracked & stained
AF 32	22-30'	2361	11	16.40	8.45	1.94	2.32	11.0	2135	Buff	Cracked & stained

Table 4, Continued

PYROPHYSICAL PROPERTIES

HOLE NO.	DEPTH	TEMPER-ATURE °F.	AT CONE	POROSITY (PERCENT)	ABSORPTION (PERCENT)	BULK SPECIFIC GRAVITY	APPARENT SPECIFIC GRAVITY	TOTAL LINEAR SHRINKAGE (PERCENT)	MODULUS OF RUPTURE IN LB./SQ. IN.	COLOR	REMARKS
AF 33	8-23'	2014	02	16.3	8.20	1.96	2.36	9.0	----	Salmon	No data, cracked, stained
AF 33	8-23'	2088	2	9.8	4.70	2.14	2.38	----	----	Light red	No data, cracked, stained
AF 33	8-23'	2134	4	9.7	4.58	2.12	2.35	----	----	Light red	No data, cracked, stained
AF 33	8-23'	2194	6	6.95	3.24	2.18	2.31	10.0	4030	Red	Cracked & stained
AF 33	8-23'	2230	7.5	11.35	5.39	2.12	2.38	11.0	4710	Red	Cracked & stained
AF 33	8-23'	2361	11	----	----	----	----	10.0	----	Dark red	No data, cracked, stained
AF 34	4-26'	2014	02	9.78	4.65	2.10	2.44	9.5	----	Salmon	No data, cracked, stained
AF 34	4-26'	2088	2	8.59	3.98	2.16	2.36	10.0	----	Red	No data, cracked, stained
AF 34	4-26'	2134	4	6.65	2.88	2.31	2.48	9.5	----	Red	No data, cracked, stained
AF 34	4-26'	2194	6	1.63	0.76	2.06	2.09	----	----	Red	No data, cracked, stained
AF 34	4-26'	2230	7.5	----	----	----	----	10.0	----	Red	No data, cracked, stained, bloated
						CATAHOULA GROUP 2					
AF 27	0-20'	2014	02	15.00	7.35	2.04	2.39	8.5	----	Salmon	No data cracked
AF 27	0-20'	2088	2	13.30	6.39	2.09	2.41	9.5	----	Red	No data cracked
AF 27	0-20'	2194	6	9.57	4.51	2.12	2.35	11.0	3390	Red	Cracked
AF 27	0-20'	2230	7.5	8.60	3.98	2.16	2.36	10.5	----	Dark red	No data cracked

Table 4, Continued

PYROPHYSICAL PROPERTIES

HOLE NO.	DEPTH	TEMPERATURE °F.	AT CONE	POROSITY (PERCENT)	ABSORPTION (PERCENT)	BULK SPECIFIC GRAVITY	APPARENT SPECIFIC GRAVITY	TOTAL LINEAR SHRINKAGE (PERCENT)	MODULUS OF RUPTURE IN 1B./SQ. IN.	COLOR	REMARKS
AF 27	0-20'	2361	11	7.76	3.62	2.16	2.35	----	----	Brown	No data cracked
AF 28	2-27'	2014	02	14.65	7.24	2.22	2.38	10.0	----	Light red	No data cracked
AF 28	2-27'	2088	2	10.90	5.18	2.10	2.35	10.5	----	Light red	No data cracked
AF 28	2-27'	2134	4	11.50	5.37	2.10	2.36	----	----	Light red	No data cracked
AF 28	2-27'	2230	7.5	----	----	----	----	12.5	----	Red	No data cracked
AF 29	6-29'	2014	02	15.60	8.90	1.95	2.34	10.0	----	Light red	No data cracked
AF 29	6-29'	2088	2	13.50	6.44	2.10	2.42	----	----	Light red	No data cracked
AF 29	6-29'	2134	4	10.15	4.90	2.08	2.34	10.0	3700	Light red	
AF 29	6-29'	2194	6	10.26	4.81	2.14	2.34	10.5	3700	Red	
AF 29	6-29'	2230	7.5	8.40	3.92	2.14	2.34	11.5	----	Red	No data cracked
AF 29	6-29'	2361	11	6.74	3.28	2.14	2.31	----	----	Red	No data cracked
					CATAHOULA GROUP 3						
AF 30	1-32'	2014	02	26.21	13.95	1.88	2.53	8.5	1258	Light red	
AF 30	1-32'	2088	2	24.3	12.45	1.91	2.52	8.5	1160	Light red	
AF 30	1-32'	2134	4	22.7	12.50	1.82	2.35	9.0	1410	Light red	
AF 30	1-32'	2194	6	23.7	12.06	1.97	2.56	9.0	1370	Red	Slight stain

Table 4, Continued

PYROPHYSICAL PROPERTIES

HOLE NO.	DEPTH	TEMPERATURE °F.	AT CONE	POROSITY (PERCENT)	ABSORPTION (PERCENT)	BULK SPECIFIC GRAVITY	APPARENT SPECIFIC GRAVITY	TOTAL LINEAR SHRINKAGE (PERCENT)	MODULUS OF RUPTURE IN 1B./SQ. IN.	COLOR	REMARKS
AF 30	1-32'	2230	7.5	23.4	12.80	1.90	2.47	8.0	1260	Red	Slight stain
AF 30	1-32'	2361	11	----	----	----	----	8.5	1895	Buff	No data
AF 31	2-20'	2014	02	22.2	10.70	2.00	2.55	8.0	2030	Light red	
AF 31	2-20'	2088	2	21.3	10.21	2.08	2.53	7.0	1920	Light red	
AF 31	2-20'	2134	4	20.2	9.88	2.02	2.52	8.5	2062	Light red	
AF 31	2-20'	2194	6	19.60	9.72	2.01	2.55	8.5	2080	Light red	
AF 31	2-20'	2230	7.5	20.20	9.00	2.01	2.65	8.0	1960	Red	
AF 31	2-20'	2361	11	19.25	9.60	2.01	2.50	7.0	1950	Grayish red	
AF 35	2-12'	2014	02	17.10	9.00	2.39	2.39	9.0	2570	Salmon	
AF 35	2-12'	2088	2	15.35	8.50	2.40	2.40	8.5	----	Light red	No data cracked
AF 35	2-12'	2134	4	14.70	9.00	2.45	2.45	9.0	2820	Light red	
AF 35	2-12'	2194	6	14.30	8.50	2.36	2.36	8.5	2920	Light red	
AF 35	2-12'	2230	7.5	15.10	9.00	2.42	2.42	9.0	3270	Red	
AF 35	2-12'	2361	11	13.90	10.00	2.43	2.43	10.0	3860	Grayish red	
					CATAHOULA GROUP 4						
AF 46	2-13'	2014	02	24.60	9.90	1.93	2.56	8.0	990	Salmon	

Table 4, Continued

PYROPHYSICAL PROPERTIES

HOLE NO.	DEPTH	TEMPERATURE °F.	AT CONE	POROSITY (PERCENT)	ABSORPTION (PERCENT)	BULK SPECIFIC GRAVITY	APPARENT SPECIFIC GRAVITY	TOTAL LINEAR SHRINKAGE (PERCENT)	MODULUS OF RUPTURE IN 1B./SQ. IN.	COLOR	REMARKS
AF 46	2-13'	2088	2	26.60	9.03	1.93	2.55	7.5	903	Salmon	
AF 46	2-13'	2134	4	25.50	10.10	1.95	2.55	8.0	1010	Salmon	
AF 46	2-13'	2194	6	24.40	10.10	1.95	2.59	8.0	1010	Light red	
AF 46	2-13'	2230	7.5	25.20	10.60	1.95	2.60	8.0	1060	Light red	
AF 46	2-13'	2361	11	24.40	11.30	1.95	2.57	6.5	1130	Buff	
AF 47	17-32'	2014	02	23.00	11.95	1.92	2.50	8.0	1390	Salmon	
AF 47	17-32'	2088	2	23.10	12.09	1.98	2.49	8.5	1630	Light red	
AF 47	17-32'	2134	4	22.10	11.15	1.94	2.49	8.5	1630	Light red	
AF 47	17-32'	2194	6	21.50	11.55	1.865	2.38	9.0	1590	Red	
AF 47	17-32'	2230	7.5	23.00	12.10	1.90	2.47	9.0	1730	Red	
AF 47	17-32'	2361	11	21.30	11.00	1.925	2.46	8.0	1920	Grayish buff	
AF 48	6-24'	2014	02	21.50	10.71	2.00	2.53	8.0	2020	Salmon	
AF 48	6-24'	2088	2	19.55	9.80	2.00	2.48	8.0	1850	Light red	
AF 48	6-24'	2134	4	18.65	9.25	2.01	2.47	7.5	2250	Light red	
AF 48	6-24'	2194	6	18.75	9.20	2.03	2.50	8.5	2280	Red	
AF 48	6-24'	2230	7.5	20.20	9.98	2.02	2.54	8.5	2190	Red	

Table 4, Continued

PYROPHYSICAL PROPERTIES

HOLE NO.	DEPTH	TEMPERATURE °F.	AT CONE	POROSITY (PERCENT)	ABSORPTION (PERCENT)	BULK SPECIFIC GRAVITY	APPARENT SPECIFIC GRAVITY	TOTAL LINEAR SHRINKAGE (PERCENT)	MODULUS OF RUPTURE IN LB./SQ. IN.	COLOR	REMARKS
AF 48	6-24'	2361	11	16.10	8.10	2.00	2.27	8.0	2580	Grayish buff	
						LOESS					
AF 41	0-14'	2014	02	24.0	12.80	1.88	2.48	4.0	1440	Light red	
AF 41	0-14'	2088	2	13.84	6.34	2.13	2.45	5.5	1680	Red	
AF 41	0-14'	2134	4	----	----	----	----	6.0	2060	Red	No data
AF 41	0-14'	2194	6	----	----	----	----	6.5	2140	Dark red	No data
AF 41	0-14'	2230	7.5	1.70	0.665	2.59	2.62	8.0	2930	Dark red	
AF 41	0-14'	2361	11	----	----	----	----	5.0	3670	Reddish brown	No data
AF 42	0-17'	2014	02	28.1	15.55	1.85	2.57	3.5	1600	Light red	
AF 42	0-17'	2088	2	16.85	8.15	2.10	2.49	4.5	1730	Red	
AF 42	0-17'	2134	4	9.25	4.42	2.09	2.28	8.0	2790	Red	
AF 42	0-17'	2194	6	6.85	3.08	2.22	2.38	11.0	3710	Dark red	
AF 42	0-17'	2230	7.5	0.327	0.143	2.26	2.33	9.0	3038	Dark red	
AF 42	0-17'	2361	11	0.175	0.112	1.95	1.976	8.0	4900	Reddish brown	
AF 43	0-21'	2014	02	24.9	12.90	1.93	2.56	4.5	1430	Light red	
AF 43	0-21'	2088	2	16.45	7.88	2.08	2.50	5.0	1760	Red	

Table 4, Concluded

PYROPHYSICAL PROPERTIES

HOLE NO.	DEPTH	TEMPERATURE °F.	AT CONE	POROSITY (PERCENT)	ABSORPTION (PERCENT)	BULK SPECIFIC GRAVITY	APPARENT SPECIFIC GRAVITY	TOTAL LINEAR SHRINKAGE (PERCENT)	MODULUS OF RUPTURE IN 1B./SQ. IN.	COLOR	REMARKS
AF 43	0-21'	2134	4	15.00	7.22	2.08	2.44	8.5	2560	Red	
AF 43	0-21'	2194	6	1.495	0.694	2.17	2.28	9.0	2600	Dark red	
AF 43	0-21'	2230	7.5	0.713	0.279	2.57	2.18	9.5	3460	Dark red	
AF 43	0-21'	2361	11	1.690	0.670	2.52	2.00	7.0	4860	Reddish brown	
AF 44	1-18'	2014	02	26.2	15.70	1.67	2.26	2.5	780	Light red	
AF 44	1-18'	2134	4	22.6	11.65	1.44	2.51	3.5	910	Red	
AF 44	1-18'	2194	6	16.45	7.56	2.12	2.55	7.0	2150	Dark red	
AF 44	1-18'	2230	7.5	17.00	8.30	2.06	2.48	6.0	1910	Dark red	
AF 44	1-18'	2361	11	4.22	1.96	2.12	2.21	5.5	2280	Reddish brown	
AF 45	1-15'	2014	02	27.8	15.00	1.85	2.60	5.5	1480	Light red	
AF 45	1-15'	2088	2	21.5	10.75	1.98	2.50	7.5	1875	Red	
AF 45	1-15'	2134	4	20.3	10.50	2.02	2.50	9.0	2250	Red	
AF 45	1-15'	2194	6	16.5	8.24	2.01	2.40	9.5	2340	Dark red	
AF 45	1-15'	2230	7.5	14.4	8.55	2.05	2.49	10.0	2320	Dark red	
AF 45	1-15'	2361	11	4.5	2.20	2.04	2.22	8.0	2860	Reddish brown	

Table 5.—Conversion table, cones to temperatures.

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

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

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

HINDS COUNTY MINERAL INDUSTRIES

WILLIAM SCOTT PARKS

ABSTRACT

Over the years Hinds County has had a variety of mineral industries. Early mineral production included mineral waters for human consumption, sandstone and limestone for building stone and riprap, clay for brick and tile, and sand and gravel for road and building construction. The discovery of the Jackson Gas Field, Hinds and Rankin Counties, in 1930 contributed much to the early mineral economy of the County as well as of the State. The Field was most productive for the first 10 years after its discovery. During this period it provided an important source of natural gas for the City of Jackson and several outlying towns. The Jackson Gas Field produced about 118.8 billion cubic feet of gas previous to 1955 when the remaining productive wells were shut-in.

In more recent years mineral production has consisted chiefly of petroleum and natural gas, clay for brick and tile and lightweight aggregate, and sand and gravel for road and highway construction. There have been three oil field discoveries: (1) Bolton Oil Field in 1954, (2) Oakley Dome Oil Field in 1955, and (3) Morgans Oil Field in 1961. The Bolton Oil Field is by far the most important of these discoveries. By the end of 1964 cumulative production for Bolton was about 11.4 million barrels of oil and 4.8 billion cubic feet of gas. Since its discovery, the value of petroleum has made up the greater part of the annual value of mineral production reported for the County. In 1963 the County ranked 19th among 59 counties reporting mineral production in the State with a value of about $4.3 million. Advanced figures for 1964 indicate a value of mineral production of about $3.6 million. This decline is due to the facts that there was a decrease in the production of petroleum and that no sand and gravel production was reported for that year.

INTRODUCTION

This report summarizes past and present mineral production in Hinds County and gives some pertinent information concerning existing mineral industries. It was prepared in order to acquaint the public with these industries and to help emphasize the importance of developing our mineral resources. Free use is made of information contained in various Bulletins of the Mississippi Geological Survey, the series Mineral Resources (U.S.G.S.) succeeded by the Minerals Yearbook of the U. S. Bureau of Mines, issues of the Oil and Gas Bulletin of the Mississippi State Oil and Gas Board, and Volumes I and II of Mesozoic-Paleozoic Producing Areas of Mississippi and Alabama published by the Mississippi Geological Society.

HISTORY OF MINERAL PRODUCTION

Through the years Hinds County has had a variety of mineral industries, but information concerning early mineral production is meager. A review of the literature shows that the rock and mineral substances produced and some of their uses include mineral waters for human consumption, sandstone and limestone for building stone and riprap, clay for brick and tile and for lightweight aggregate, sand and gravel for road and building construction, marl and limestone for agricultural lime, and petroleum and natural gas.

Among the first substances considered as mineral production were mineral waters produced from the so-called mineral springs or wells. Wailes[1] in his report on the agriculture and geology of Mississippi published in 1854 mentions Mississippi Springs near Clinton and Coopers Well near Raymond as sources of mineral water. In the past there have been health resorts at both of these places. The early Mineral Resources series of the U. S. Geological Survey show that mineral water production was reported sporadically over the years from Alkanasia Spring near Jackson and from Miltons Well and Coopers Well both near Raymond. This mineral water was bottled and sold for table and medicinal use. In 1923 the U. S. Geological Survey discontinued its canvass of mineral waters.

The indurated sandstones and quartzites of the Catahoula formation and the limestone of the Vicksburg group were utilized as early construction materials. Wailes[2] in 1854 mentions several quarries located in the County. He states that sandstone was produced from a quarry near Raymond and that limestone was produced from the Steward Quarry west of Clinton, the Marshall Quarry near Mississippi Springs, and the Long Quarry south of Jackson. The sandstone was used in the foundations of houses and buildings and in the construction of chimneys. The limestone, in addition to its chief use as a building stone, was also utilized as a monumental stone and for making burnt lime. In a later report Monroe[3] describes the sandstone quarry near Raymond and also the Gant Quarry located near Terry. He states that the sandstone from the Gant Quarry was used for building stone, riprap on levees and floors of spillways, and railroad ballast.

The brick and tile industry had early beginnings in Hinds County. In a report on the brick clays and clay industry of northern Mississippi published in 1907, Logan[4] describes two brick plants located at Jackson. They were the W. B. Taylor plant, established in 1881, and the Bullard Brick Manufacturing Company, established in 1899. Also, on a provisional geologic and topographic map of the State accompanying the report, brick plants were shown located at Edwards and Utica. Brick and tile plants that were established later include the Jackson Brick Company, the Johnson-Cone Brick Company and the Tri-State Brick & Tile Company, Inc., all of which were located at Jackson. Tri-State Brick & Tile is the only plant now in operation.

For many years sand and gravel has been produced for use in road construction and as railroad ballast. In a report on the road-making materials of the State published in 1920, Lowe[5] gives information concerning several sand and gravel pits scattered over the County. Individual pits are described as to their locations in relationship to Raymond, Jackson, Forest Hill, Edwards, Bolton, and Terry. The material was used as road surfacing and in concrete pavements. Since this report was published, there have been many other pits opened to provide materials for road and highway construction. Also, some sand and gravel has been produced for local use in building.

The discovery of the Jackson Gas Field, Hinds and Rankin Counties, in 1930 contributed much to the early mineral economy of the County as well as of the State. The value of mineral production for Mississippi in 1929 was only about $2.6 million. By 1939 it had reached about $5.2 million of which over $3 million was value of natural gas produced from the Jackson Field. For a period of about 10 years after its discovery, the Field provided a source of natural gas used in the City of Jackson and in several outlying towns. This readily available supply of fuel probably contributed much to the early industrial development of the Jackson area. Production reached its peak in 1939 with an annual production of 15.1 billion cubic feet of gas. It declined rapidly thereafter, and the last several productive wells were shut-in in 1955. Nevertheless, the Field still serves an important and useful purpose inasmuch as the Rankin County portion has been converted to a gas storage facility.

Since 1952 the Bureau of Mines has included in the Minerals Yearbook a brief review of the mineral industries operating in the various counties of the State, and the value of mineral production for each county is given for preceding years. The value of mineral production for Hinds County from 1953 to 1964 is shown graphically in Figure 1. The actual reported production figures and the minerals produced are given in Table 1.

Table 1

Hinds County Mineral Production, 1953-64*

Year	Value	Minerals produced, in order of importance
1953	$79,136	Not reported.
1954	253,838	Petroleum, clay, natural gas, sand and gravel.
1955	1,420,817	Petroleum, clays, natural gas, natural gas liquids.
1956	2,396,040	Petroleum, sand and gravel, clays, natural gas.
1957	4,007,544	Petroleum, sand and gravel, clays, natural gas.
1958	3,966,778	Petroleum, sand and gravel, clays, natural gas.
1959	4,873,742	Petroleum, sand and gravel, clays, natural gas.
1960	5,090,243	Petroleum, sand and gravel, clays, natural gas.
1961	4,500,110	Petroleum, sand and gravel, clays, natural gas, stone.
1962	4,317,469	Petroleum, sand and gravel, clays, natural gas.
1963	4,342,247	Petroleum, sand and gravel, clays, natural gas.
1964	3,657,727	Petroleum, clays, natural gas.

*Compiled from the Minerals Yearbook (1953-63) published by the U. S. Bureau of Mines; the value for 1964 is an advanced figure.

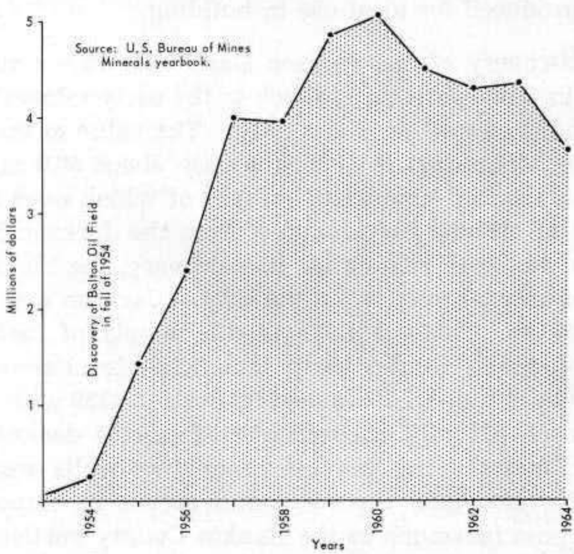

Figure 1.—Value of Hinds County mineral production, 1953-64.

In Figure 1 and Table 1 are shown a sharp increase in mineral production after 1954. This is attributed to the added value of petroleum produced from the Bolton Oil Field which was discovered in the fall of that year. Since this discovery, petroleum has made up by far the greater part of the annual value of mineral production reported for the County. During this period, two brick plants that had operated for many years went out of business—the Jackson Brick Company in 1954 and the Johnson-Cone Brick Company in 1961. However, the establishment of the Lightweight Aggregate Division of Jackson Ready-Mix Concrete, a clay-using industry, in 1958 and the increased production at the Tri-State Brick & Tile Company, Inc. have more than compensated for these losses. In fact since 1959 the County has been reported among the leading counties in the State in tonnage of clay mined. For a five year period (1959-63), the County has been reported among the leading counties in sand and gravel production, but it is believed that part of this production was actually in Copiah County and was erroneously reported for Hinds. There was no sand and gravel production reported for 1964. In 1963 Hinds County ranked 19th among 59 counties reporting mineral production in the State.

OIL AND GAS INDUSTRY

To date four oil and gas fields have been discovered in Hinds County. They are the Jackson Gas Field, Bolton Oil Field, Oakley Dome Oil Field and Morgans Oil Field. The discovery of the Jackson Gas Field in 1930 was significant in the early history of oil and gas development in Mississippi. This discovery, along with the previously discovered Amory Gas Field, provided the incentive for exploration which, in time, led to the finding of larger and more profitable oil and gas fields in the State. The Bolton Oil Field, discovered in 1954, is by far the most important oil field thus far found in the County. The Oakley Dome Oil Field and the Morgans Oil Field were abandoned after a short and insignificant production history.

JACKSON GAS FIELD

The Jackson Gas Field, located in Hinds and Rankin Counties, encompasses an area which includes part of the City of Jackson and the Town of Flowood (Plate 1). The field was discovered by the Jackson Oil & Gas Company No. 1 Mayes drilled to a total depth of 2,465 feet. This well was completed in February 1930 from open hole at an approximate depth of 2,360 to 2,400 feet. Open flow potential was 15 million cubic feet of gas per day. Many development wells were drilled, and by 1934 there were as many as 113 producing wells. The early development of the Jackson Gas Field is described in reports by Monroe[6] in 1931, Munroe[7] in 1935, Monroe and Toler[8] in 1937, and Monroe[9] in 1954.

The reservoir rock consists of a more or less porous, chalky, reef-type limestone which grades downward into pure, soft crystalline limestone. Some parts of the reservoir rock are very porous and contain cavities. The gas rock is of Upper Cretaceous age. The structural anomaly at Jackson was first noted by Hilgard [10] in 1860 in his report on the geology and agriculture of the State. Hilgard noted reversal of dips in the surface formations and attributed this to possible local upwarping. Many years later, Hopkins[11] prepared a report on the structure of the Jackson-Vicksburg area. His structure map, contoured on the top of the Vicksburg limestone, outlined the Jackson Dome. The Jackson Dome is an anticlinal dome formed by the arching of strata over a deep-seated igneous plug.

Figure 2 shows the annual production of gas from the Jackson Gas Field. Annual production was at a maximum in 1939 with 15.1 billion cubic feet of gas produced that year. Since then production has decreased rapidly. In February 1955 the remaining wells were shut-in, and the Rankin County portion was converted to a gas storage facility by the United Gas Pipeline Company. Cumulative production as of December 31, 1954 was 118,794,645 thousand cubic feet of gas. Even though there was no production of oil considered to be commercial, four wells on the south edge of the gas reservoir in Rankin County produced some heavy asphaltic oil. Oil production from all wells is reported to be 20,000 barrels.

BOLTON OIL FIELD

The Bolton Oil Field is located in and around the town of Bolton in Sections 13, 14, 23, and 24, Township 6 North, Range 3 West and in Sections 18 and 19, Township 6 North, Range 2 West (Plate 1). The initial field discovery was made by the Larco Drilling Company No. 1 Lettie McAlpin *et al* which was drilled to a total depth of 9,951 feet. After encountering several shows of oil in the Paluxy below 8,800 feet, the well was completed August 2, 1954 through perforations in the casing between the depths of 9,920 and 9,940 feet opposite a basal Paluxy sandstone.

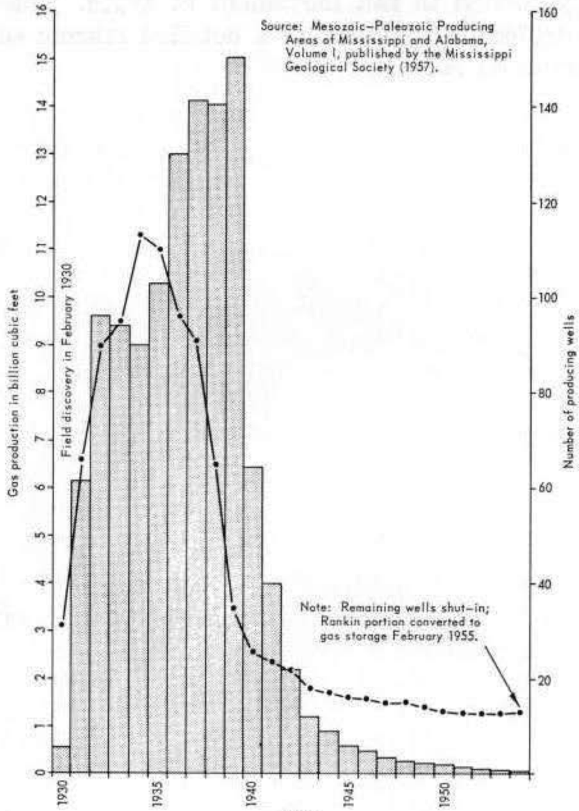

Figure 2.—Production of natural gas from Jackson Gas Field.

Initial production was 288 barrels of 38.3° API gravity oil per day. Since the discovery, many development wells have been drilled, and several additional pools have been discovered (Figure 3). Information concerning the discovery wells of the various pools are summarized in Table 2.

The Field produces from various intervals in the Washita-Fredericksburg, Paluxy, Mooringsport, Rodessa, Sligo, and Hosston formations of Lower Cretaceous age. The reservoir rocks consist of lenticular sandstones associated with shales. The sandstones range from medium-grained to very fine-grained and are variably silty and shaley. Basic reservoir data are given in Table 4. The structure is an elongate, northwest-southeast trending anticline having graben faulting. The origin of the structure is probably related to salt movement at depth. The discovery well was drilled on the basis of a detailed seismic survey of a gravity minimum anomaly.

Table 2

Bolton Oil Field Discovery Wells

Operator and Well Name	Completion date	Location	Initial production (BOPD)*	Producing depths (feet)	Oil Pool Discovery
Larco No.1 McAlpin	7-29-54	19-6N-2W	293	9,920-40	Paluxy - initial field discovery.
Magnolia No.1 Cockrum	12-26-54	19-6N-2W	59	10,559-61	Rodessa - established production on east upthrown fault block.
Larco No.1-A Gaddis	11-27-55	13-6N-3W	314	10,850-74	Rodessa - established production on graben segment.
Weston No.3 Gaddis	8-6-59	13-6N-3W	184	10,254-74	Mooringsport.
Weston No.6 Gaddis	Tested April 1957	13-6N-3W	198 260	11,682-86 11,794-96	Hosston - well plugged back and completed from Rodessa.
Jett No.2 Roberts	9-16-57	24-6N-3W	231	11,403-15	Sligo.
Sun No.1 Lancaster-McAlpin	6-16-58	19-6N-2W	212	8,359-73	Washita-Fredericksburg.
Jett No.1 Gaddis	10-18-59	14-6N-3W	150	10,722-34	Rodessa - established production on west upthrown fault block.

*Barrels of oil per day.

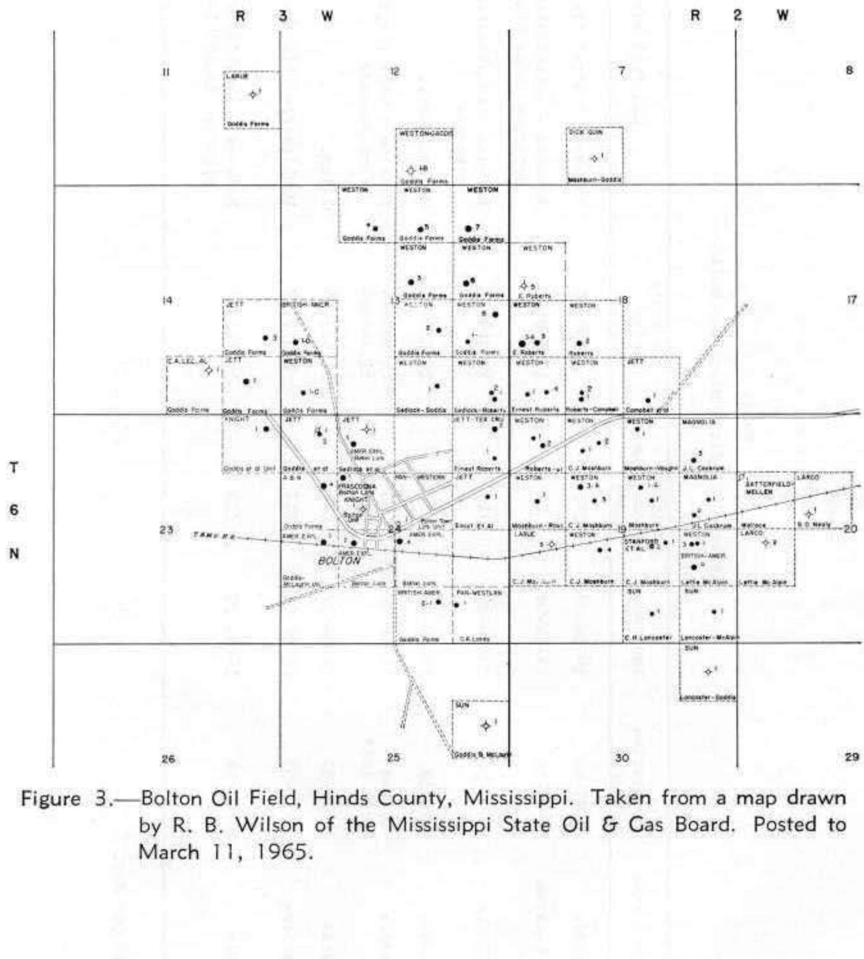

Figure 3.—Bolton Oil Field, Hinds County, Mississippi. Taken from a map drawn by R. B. Wilson of the Mississippi State Oil & Gas Board. Posted to March 11, 1965.

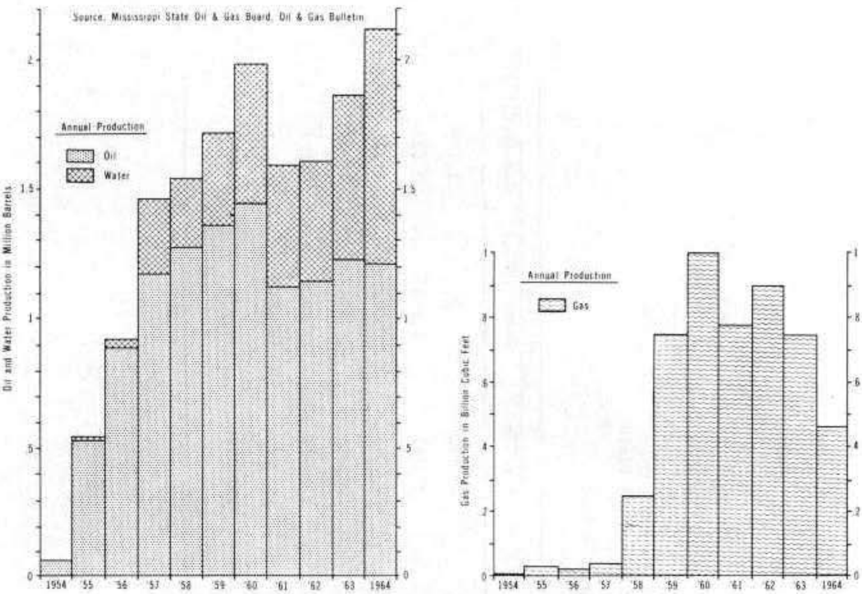

Figure 4.—Production of oil, water and gas from Bolton Oil Field, 1954-64.

Figure 4 shows the annual production of oil, water and gas for the Bolton Oil Field from 1954 to 1964. Table 3 gives annual and cumulative production for the various pools. Annual production was at a maximum in 1960 with about 1.4 million barrels of oil and a billion cubic feet of gas produced that year. Since then the production of oil and gas has declined somewhat, and the quantity of water has increased steadily. Nevertheless, additional development wells are being drilled and completed. Cumulative production as of December 31, 1964 was 11,418,417 barrels of oil, 3,985,658 barrels of water and 4,771,454 thousand cubic feet of gas.

Table 3A

Production Statistics for Bolton Oil Field

Washita-Fredericksburg Oil Pool

Year	Producing Wells	Annual			Cumulative		
		Oil (BBL.)	Water (BBL.)	Gas (M.C.F.)	Oil (BBL.)	Water (BBL.)	Gas (M.C.F.)
1958	1	29,592	0	1,238	29,592	0	1,238
1959	1	58,171	1,690	2,385	87,763	1,690	3,623
1960	1	96,079	4,200	3,701	183,842	5,890	7,324
1961	1	52,649	22,534	2,262	236,491	28,424	9,586
1962	1	37,385	38,576	1,704	273,876	67,000	11,290
1963	2	37,091	112,903	2,197	310,967	179,903	13,487
1964	4	69,767	218,035	4,127	380,734	397,938	17,614

Table 3B

Production Statistics for Bolton Oil Field*

Paluxy Oil Pool

Year	Producing Wells	Annual			Cumulative		
		Oil (BBL.)	Water (BBL.)	Gas (M.C.F.)	Oil (BBL.)	Water (BBL.)	Gas (M.C.F.)
1954	5	68,259	0	3,894	68,259	0	3,894
1955	14	492,595	8,272	15,524	560,854	8,272	19,418
1956	15	613,907	33,009	11,289	1,174,761	41,281	30,707
1957	15	546,688	172,178	12,300	1,721,449	213,459	43,007
1958	14	458,170	143,611	31,354	2,179,619	357,070	74,361
1959	14	376,953	118,067	35,013	2,556,572	475,137	109,374
1960	13	354,173	234,664	36,745	2,910,745	709,801	146,119
1961	13	331,453	308,659	36,977	3,242,198	1,018,460	183,096
1962	14	282,511	231,789	37,409	3,524,709	1,250,249	220,505
1963	14	249,083	241,972	34,867	3,773,792	1,492,221	255,372
1964	11	218,465	322,678	21,017	3,992,257	1,814,899	276,389

*Compiled from records of the Mississippi State Oil and Gas Board.

Table 3C

Production Statistics for Bolton Oil Field

Mooringsport Oil Pool

Year	Producing Wells	Annual			Cumulative		
		Oil (BBL.)	Water (BBL.)	Gas (M.C.F.)	Oil (BBL.)	Water (BBL.)	Gas (M.C.F.)
1956	1	8,211	0	0	8,211	0	0
1957	2	26,477	200	0	34,688	200	0
1958	5	73,453	1,200	12,922	108,141	1,400	12,922
1959	4	33,402	4,318	8,987	141,543	5,718	21,909
1960	4	18,419	847	5,526	159,962	6,565	27,435
1961	3	22,703	1,595	6,040	182,665	8,160	33,475
1962	2	19,249	1,997	2,778	201,914	10,157	36,253
1963	2	30,272	807	4,243	232,186	10,964	40,496
1964	4	54,438	7,522	8,871	286,624	18,486	49,367

Table 3D

Production Statistics for Bolton Oil Field

Rodessa Oil Pools Combined

Year	Producing Wells	Annual Oil (BBL.)	Annual Water (BBL.)	Annual Gas (M.C.F.)	Cumulative Oil (BBL.)	Cumulative Water (BBL.)	Cumulative Gas (M.C.F.)
1955	2	33,972	2,146	1,359	33,972	2,146	1,359
1956	10	259,411	7,807	2,481	293,383	9,953	3,840
1957	16	566,897	119,124	5,791	860,280	129,077	9,631
1958	18	570,453	108,330	89,249	1,430,733	237,407	98,880
1959	20	551,932	195,687	155,963	1,982,665	433,094	254,843
1960	20	544,355	267,716	141,176	2,527,020	700,810	396,019
1961	15	437,121	89,554	128,538	2,964,141	790,364	524,557
1962	16	485,331	116,099	184,789	3,449,472	906,463	709,346
1963	17	621,544	137,952	209,713	4,071,016	1,044,415	919,059
1964	20	678,859	125,669	186,008	4,749,875	1,170,084	1,105,067

Table 3E

Production Statistics for Bolton Oil Field

Sligo Oil Pool

Year	Producing Wells	Annual			Cumulative		
		Oil (BBL.)	Water (BBL.)	Gas (M.C.F.)	Oil (BBL.)	Water (BBL.)	Gas (M.C.F.)
1957	3	29,886	383	3,541	29.886	383	3,541
1958	3	44,901	6,484	7,926	74,787	6,867	11,467
1959	4	11,704	15,269	4,435	86,491	22,136	15,902
1960	3	6,681	8,453	2,710	93,172	30,589	18,612
1961	1	3,766	19,859	2,710	96,938	50,448	21,322
1962	2	1,016	4,333	1,924	97,954	54,781	23,246
1963	2	29,612	23,620	24,092	127,566	78,401	47,338
1964	1	19,501	33,563	60,077	147,067	111,964	107,415

Table 3F

Production Statistics for Bolton Oil Field

Hosston Oil Pool

Year	Producing Wells	Annual			Cumulative		
		Oil (BBL.)	Water (BBL.)	Gas (M.C.F.)	Oil (BBL.)	Water (BBL.)	Gas (M.C.F.)
1958	2	94,344	1,250	112,305	94,344	1,250	112,305
1959	7	326,650	24,329	542,507	420,994	25,579	654,812
1960	7	422,694	21,405	819,933	843,688	46,984	1,474,745
1961	7	275,877	21,077	605,799	1,119,565	68,061	2,080,544
1962	8	311,056	77,805	671,501	1,430,621	145,866	2,752,045
1963	6	258,854	123,380	277,857	1,689,475	269,246	3,029,902
1964	5	172,385	230,041	185,700	1,861,860	472,287	3,215,602

Table 4

Basic Reservoir Data for Hinds County Oil Fields*

Field	Reservoir	Average Producing Depth (feet)	Spacing	Average Thickness (feet)	Approx. Productive Acres	Porosity (percent)	Permeability (Md.)**	Connate Water (percent)	Oil-Water Contact	Formation Volume Factor	Bottom Hole Temp. (°F.)	Bottom Hole Pressure (PSI)	Gravity Oil (°API)
Bolton	Washita-Fredericksburg	8,360	40	20	40+	17	200	13.8	-8124	-	-	-	13
	Paluxy	9,900	40	30	640	17	200	11	-9730	1.175	243	4627	39
	Mooringsport	10,300	40	20	120	15	100	15	-	1.20	265	1303	41
	Rodessa	10,500	40	21	680	16	150	28	-10615	.797	240	4689	42
	Sligo	11,530	40	15	120	15	50	20	-	-	249	-	50
	Hosston	11,550	40	24	320	17	150	20	-11484	.97	276	5145	53
Oakley Dome	Wilcox	2,403	10	6	10	29	24-127	-	-	1.10	106	425	36
Morgans	Rodessa	13,020	40	10	40	23	0 -50	-	-	-	236	6050	47

*From Mesozoic-Paleozoic Producing Areas of Mississippi and Alabama, Volume II (1963) published by the Mississippi Geological Society and the Oil and Gas Bulletin of the Mississippi State Oil and Gas Board.

**Millidarcies.

OAKLEY DOME OIL FIELD

The Oakley Dome Oil Field, located about 3.5 miles southwest of Raymond in Section 27, Township 5 North, Range 3 West, was discovered by the Walter E. Sistrunk No. 1-A H. T. Shuff Unit (Plate 1). This well was drilled to a total depth of 2,433 feet and bottomed in the Wilcox. After prolonged testing, the well was completed March 9, 1955 through perforations in the casing between the depths of 2,400 and 2,406 feet. On initial production, the well flowed seven barrels of 37° API gravity oil and five barrels of salt water in 24 hours. Offset drilling resulted in only dry holes.

The reservoir rock is two feet of gray-green, medium-grained, glauconitic, porous sand and four feet of gray, fine-grained porous sand that is slightly shaley in the lower part. Basic reservoir data are given in Table 4. The structure is the Oakley Dome, a shallow piercement-type salt dome, which was found in 1949 by exploratory drilling. Showings of oil were noted in the Wilcox in the initial test well.

As of December 31, 1963, the date the Field was reported to have been temporarily abandoned, cumulative production was 3,760 barrels of oil and 182 barrels of water. Although the Oakley Dome Oil Field has not proved to be a significant producer, this discovery is important because it established oil production on one of the State's many piercement-type salt domes. Also, it is important because it established Wilcox production about 50 miles up dip from the nearest proven Wilcox productive areas in Jefferson County.

MORGANS OIL FIELD

Morgans Oil Field is located about 5 miles southwest of Terry in Section 26, Township 3 North, Range 2 West (Plate 1). The discovery well was drilled as the Texas Pacific Coal and Oil No. 1 Walter Wolfe. This well was completed as Olin Oil and Gas No. 1 Walter Wolfe and was produced as Humble Oil and Refining Company No. 1 Walter Wolfe. It was drilled to a total depth of 14,556 feet and bottomed in the Hosston. The well was completed November 3, 1961 through perforations in the casing between the depths of 13,008 and 13,042 feet opposite a Rodessa sandstone of Lower Cretaceous age. Initial Production was 62 barrels of 47° API gravity oil and 20 barrels of water per day. No offset wells were drilled.

The reservoir rock is a fine-grained, subangular sandstone having erratic porosity. Basic reservoir data are given in Table 4. The structure is reported to be probably a low relief anticline and restrictive porosity in a tight Rodessa sandstone. The discovery well was drilled following seismic exploration.

As of December 31, 1963, the date the Field was reported to have been abandoned, cumulative production was 10,417 barrels of oil, 1,719 barrels of water, and 2,041 thousand cubic feet of gas.

CLAY INDUSTRY

The present clay industry in Hinds County consists of a brick manufacturing company and a lightweight aggregate producing operation, both of which use local materials. There is also a plant which processes Mississippi bentonite for use as a bleaching clay and as a desiccant. Even though the latter industry does not use Hinds County materials, it is described briefly herein because of its economic importance to the area. All of these industries are located in or near the City of Jackson.

TRI-STATE BRICK & TILE COMPANY

The Tri-State Brick & Tile Company is the only brick manufacturing company operating in the Jackson area (Figure 5). The plant is located on the Yazoo & Mississippi Valley Branch of the Illinois Central Railroad (SW.¼, Sec.8, T.6N., R.1E.) about six air miles northwest of downtown Jackson (Plate 1.) Construction of the plant began in October 1945, and the first brick was produced on April 27, 1946. Since then the plant has operated continuously.

The chief raw materials used are clays and clay loam. Redburning material is strip mined at pits located adjacent to the plant. This material is a highly weathered clay loam which is residual from a thin blanket of loess deposited over Yazoo clay. Light-burning Wilcox clays are brought-in from strip mines located near Louisville in Winston County. Minor raw materials include small amounts of various ingredients imported from outside the State to be used in coloring some brick and in obtaining certain surface effects.

In the operation, the clay is prepared by crushing, pulverizing, screening, blending, extruding and cutting into units. The raw bricks are stacked on kiln cars having capacities of 2,800 brick. The loaded cars are moved along tracks through a dryer and then into a tunnel kiln. There are four driers and four tunnel kilns fired with natural gas supplied by the Mississippi Valley Gas Company. Each tunnel kiln has a 34-car capacity. Kiln temperatures range up to 2100°F. After leaving the kiln,

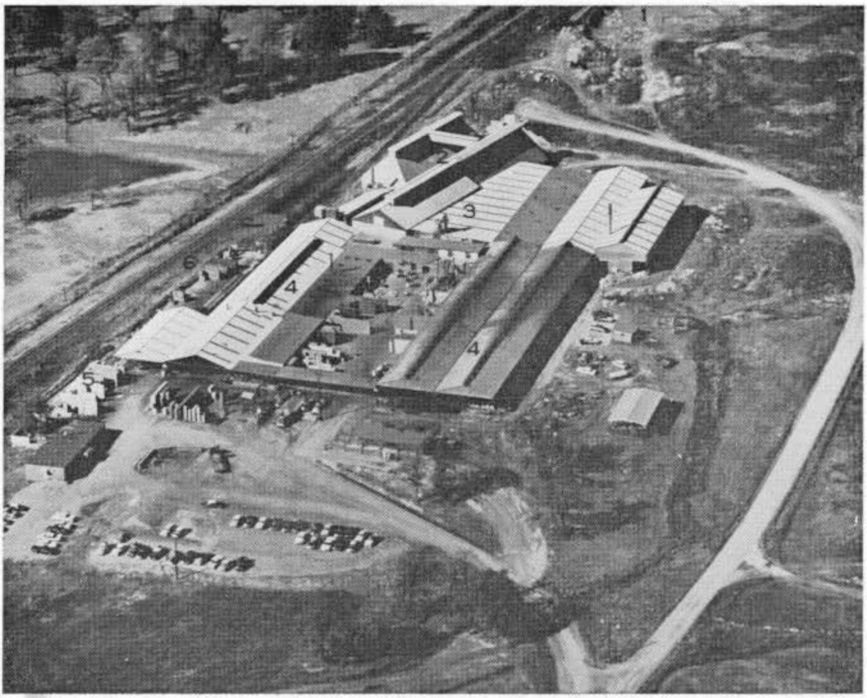

Figure 5.—Tri-State Brick & Tile Company plant near Jackson: (1) pit opened in clay loam, (2) dry clay storage, (3) clay preparation facilities, (4) driers and tunnel kilns, (5) finished bricks, (6) rail and truck loading areas. Photo by Hand Portraits, December 1963.

the bricks are processed further if necessary and stacked for shipment in 500-brick lots. Shipment is by both rail and truck.

The Company produces a wide variety of brick including red common brick and various shades, textures and styles of face brick. At one time tile was produced but none at present. The original capacity of the plant was 30,000 brick per day, but over the years the Company has followed a continuing expansion program. The latest expansion, in 1964, increased plant capacity from 96,000 to 160,000 brick per day.

LIGHTWEIGHT AGGREGATE DIVISION

Expanded clay aggregate production by the Lightweight Aggregate Division of Jackson Ready-Mix Concrete began July 1, 1958 (Figure 6). The plant is located at Cynthia on the Yazoo & Mississippi Valley Branch of the Illinois Central Railroad (NW.¼, Sec.36, T.7N., R.1W.) about nine air miles northwest of downtown Jackson (Plate 1). Natural gas is supplied for the kiln by a line of the Mississippi Valley Gas Company extending from the City of Jackson. The raw material is the Yazoo clay which crops out extensively in the area and has a maximum thickness of about 400 feet. The mine is an open-cut pit over 60 feet deep that has several tiered benches from which the clay is worked (Figure 7). Both the weathered and unweathered Yazoo clay is utilized.

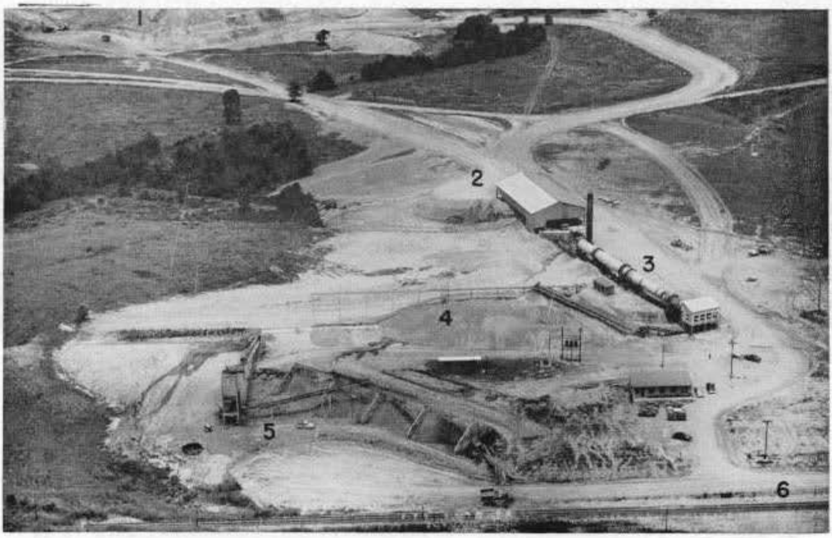

Figure 6.—Lightweight Aggregate Division plant of Jackson Ready-Mix Concrete at Cynthia: (1) pits opened in the Yazoo clay, (2) clay dry shed, (3) rotary kiln, (4) cinder storage area, (5) grinding, screening and storage of graded aggregates, and (6) rail or truck shipping facilities. (M.G.S. Bull. 86, Fig. 24).—Frank Noone photo, July 2, 1958.

In the operation the clay is stripped with a dragline and hauled by truck a short distance to the dry shed at the feeding end of the kiln. From the dry shed the clay is moved with a front-end loader to the blender. From the blender the clay is carried along a conveyor to the rotary kiln which is 12 feet in diameter and 200 feet long. In the kiln the clay reaches a temperature of 2200°F. In the firing process the clay is calcined and bloated to form a cinder. As the cinder leaves the kiln it is

Figure 7. Open-cut pit of the Lightweight Aggregate Division, Jackson Ready-Mix Concrete (NE.¼, NW.¼, Sec.36, T.7N., R.1W.). The mine is over 60 feet deep. Note the several tiered benches from which the clay is worked.—Bob Hand photo.

picked up by a conveyor and carried to the cinder pile. From the cinder pile the material is carried by conveyor to a hammer mill where it is crushed. From the hammer mill the aggregate is carried to a series of screens where it is sized and dumped into finished bins. Stock sizes are three-quarters- to three-eighths-inch, three-eighths- to three-sixteenths-inch and three-sixteenths-inch to dust. The aggregate is moved from the finished bins, blended when gradations other than stock sizes are required, and loaded into rail cars or trucks for delivery.

Production was reported in 1959 to be 300 tons of graded aggregate daily. The product is used chiefly by the producers of concrete block throughout the State, but through sales promotion it is finding a variety of other uses. It is used for lightweight structural aggregate, lightweight insulation aggregate, roofing granules, bituminous road surfacing, bituminous plant mix and athletic tracks.

FILTROL CORPORATION

Since 1936 the Filtrol Corporation has operated a bentonite activation plant at Jackson (Figure 8.) The plant is located on the north side of McDowell Road adjacent to the Gulf, Mobile & Ohio Railroad (SW.¼, Sec.16, T.5N., R.1E.) about two air miles southwest from the downtown Jackson area (Plate 1).

The chief raw material is bentonite which is shipped to the plant by rail from Filtrol's several mines, some of which are located in Monroe and Itawamba Counties and others in Smith County. Other bentonite of a different type is imported from Louisiana and Oklahoma.

Figure 8.—Filtrol Corporation's bentonite activation plant at Jackson. Looking northeast. (M.G.S. Bull. 86, Fig. 21). Photo by Manley, Tucson.

The plant produces a bleaching clay that is used as a decolorizer in refining oils and other substances that respond to the highly adsorbent properties of the activated clay. Also produced is pelletized desiccant used in packaging for static dehumidification.

SAND AND GRAVEL INDUSTRY

Hinds County, especially the greater Jackson area, provides an important market for sand and gravel because of the large volume of construction. In recent years there has been an extensive highway program underway, including the construction of Interstate Highways 20 and 55 and the improvement of various Federal, State and County roads. In addition to this demand, the building industry in and around Jackson and Clinton has expanded greatly to meet the needs of rapidly growing populations in those areas. Even though some sand and gravel is produced in the County, the larger part is brought in from commercial operations located near Crystal Springs and near Brookhaven.

For a five year period (1959-63) Hinds County has been reported among the leading counties in the State in sand and gravel production. During this time the Traxler Gravel Company, Inc. has been the only commercial operator to report production. Traxler, headquartered at Utica, operates two plants —one near Crystal Springs in Copiah County and the other near Utica. The operation near Utica consists of a portable washing plant which produces paving sand and gravel. Over the years this plant has been located at various places along White Oak Creek in Hinds and Copiah Counties and along Bayou Pierre in Copiah County. It is believed that some production which actually was in Copiah was reported erroneously for Hinds. The plant is presently on Bayou Pierre. On March 20, 1961 all of the outstanding capital stock of the Traxler Gravel Company, Inc. along with other Traxler corporations was acquired by Jackson Ready-Mix Concrete. Since the latter part of October 1961 the Traxler operation has made up the Sand and Gravel Division of Jackson Ready-Mix.

Other sand and gravel production, classed as non-commercial, is by government-and-contractor operations. There are many topping pits scattered over the County which supply sand and gravel for use in the construction of highways and in improving roads (Figure 9). This material is produced by the State Highway Department and the Hinds County Board of Supervisors or by private contractors for these agencies. Much of this production is not reported.

Data concerning 22 topping pits prospected by the State Highway Department in Hinds County from about 1947 to 1963 are given in Table 5. These are not all of the pits worked by the Highway Department and the Board of Supervisors during this period, but only those for which test data were readily

Figure 9.—Hinds County Board of Supervisors topping pit (No. 5-959) located on the Tinnin road about 4 miles north of Clinton (Center Sec.31, T.7N., R.1 W.). Photo by Perry Nations. March 5, 1965.

available. Nevertheless, these pits are considered to be representative of materials produced in the County. Pits 5-926, 5-959, 5-1023, 5-1024 and 5-1025 are pits sampled and tested by the Highway Department for use on State aid roads. The information concerning the area of the pits and the quantities of material and overburden was not available. In Table 5 Highway Department pit numbers and project designations are included in order to provide reference to Department files. The general locations of the pits are shown on Plate 1.

During the exploration for the topping pits, several test holes were drilled on each prospect in order to obtain samples for testing. Mechanical analyses were made on the many samples taken. From these findings, an average analysis was calculated for usable material in each test hole, then the pit range and pit average. In determining the pit range and pit average, each size classification is considered individually. The pit range is the lowest and the highest of the test hole averages, and the pit average is the total of the test hole averages divided by the number of holes.

The geologic distribution of the pits is 20 in Terrace Deposits and 2 in Alluvium. The total quantity of material prospected in 17 pits is approximately three million cubic yards. In summary of the data showing the sizes of the pits and the quantities of usable material and overburden:

(1) the area of 22 pits ranged from 1.1 to 31.8 acres, but averaged about 9 acres;

(2) the quantity of material in 17 pits ranged from 20,000 to 638,000 cubic yards, but averaged about 175,000 cubic yards; and

(3) the quantity of overburden in 17 pits ranged from 0 to 213,000 cubic yards, but averaged about 58,000 cubic yards.

AGRICULTURAL LIME INDUSTRY

In the late summer of 1961, Southern Materials of Mississippi, Inc. began production of agricultural lime at a plant located on the Yazoo & Mississippi Valley Branch of the Illinois Central Railroad (NE.¼, SE.¼, Sec.1, T.5N., R.2W.) about 1.5 miles west of McRaven. The raw material was the limestone and marl of the Vicksburg group. The limestone and marl were quarried using a dragline, pulverized in a rock crusher, and stored in an open pile. The deposit is reported to have contained an estimated quantity of 3,230,000 tons. Also, it is reported that analyses show the materials ranged from 86.2 to 92.6 percent calcium carbonate equivalent. Production was discontinued in 1963.

ACKNOWLEDGMENTS

Acknowledgments are due Mr. H. M. Morse and Mr. Rogers S. Myers, Jr. of the Mississippi State Oil & Gas Board; Mr. C. C. Parsons, Mr. Arthur P. Scoggin and Mr. Clyde V. Clark of the Mississippi State Highway Department; Mr. Lloyd A. West of the Mississippi Agricultural & Industrial Board; Mr. W. H. Day of Jackson Ready-Mix Concrete; Mr. A. T. Henson of Tri-State Brick & Tile Company; Mr. C. T. Millice, Jr. of the Filtrol Corporation; and Mr. N. A. Kendall of the U. S. Bureau of Mines for providing certain information concerning Hinds County mineral industries.

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STATEMENT OF POLICY IN STRATIGRAPHIC NOMENCLATURE

The Mississippi Geological Survey has many requests for "official statements" on geologic nomenclature. At the present time we do not recognize that we have any "official nomenclature." Geologic knowledge is accrual: therefore, geologic conclusions and the nomenclature of geology are subject to review and to revision.

The rules of stratigraphic nomenclature are understood by us, by the geologists of the Surveys of our sister States, by those of the U. S. Geològical Survey and by most other geologists. They are most recently expressed by American Commission on Stratigraphic Nomenclature in its "Code of Stratigraphic Nomenclature," A. A. P. G. Bull. Vol. 45, No. 5, pp. 645-665, May, 1961.

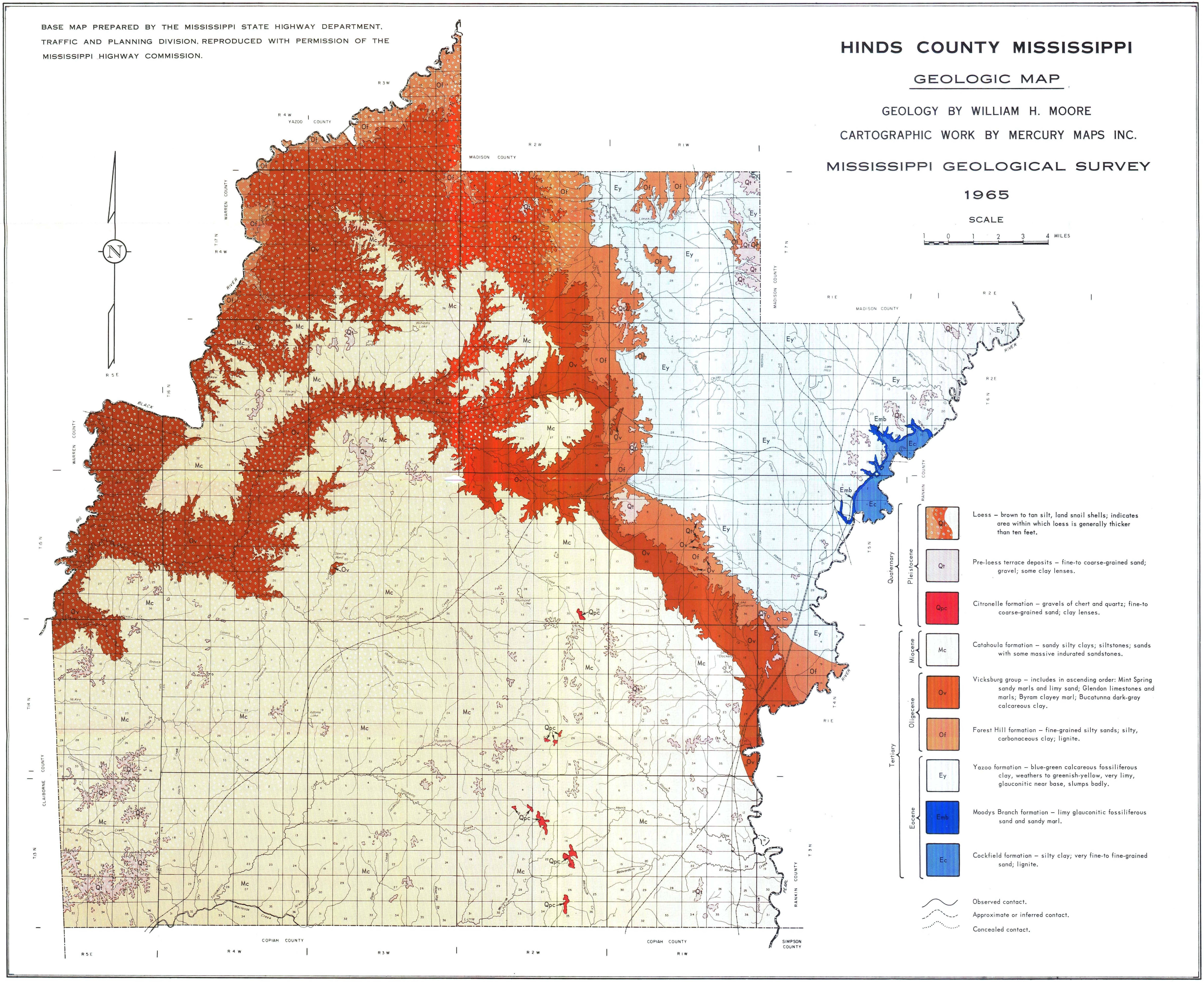
The problems being studied continually by us are those of stratigraphic nomenclature and taxonomy as they affect our economic investigations. Ranking of stratigraphic units appears to change as the detail of geologic knowledge unfolds. Is this advisable, desirable, or necessary? At what degree should "usage" take precedence over "priority?" These are some of the questions that concern us.

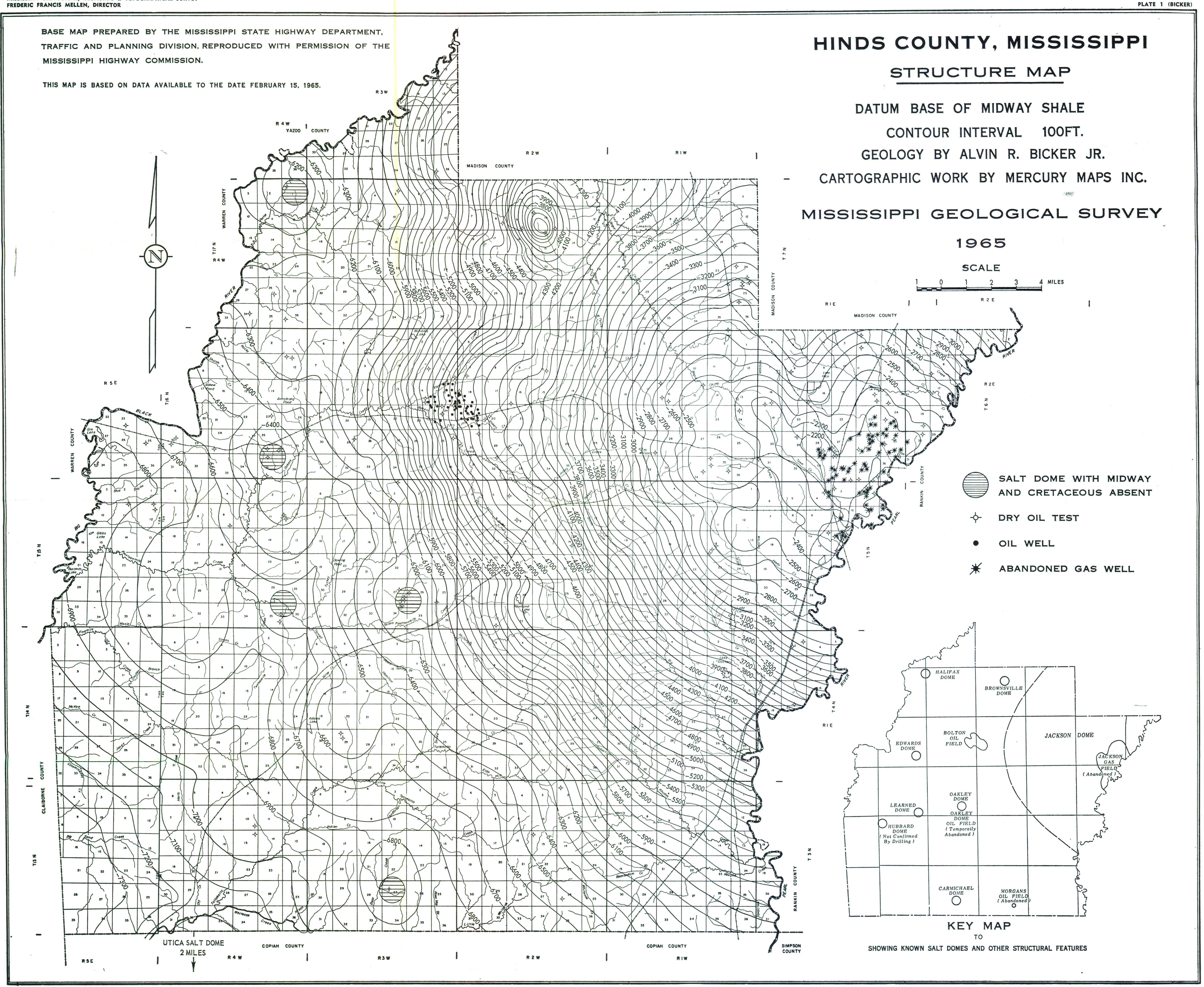
We are definitely working in the direction of standardization of nomenclatural usages. We are anxious to cooperate with other departments, geologists and organizations in the simplification and better definition of our nomenclature. We feel that it is a bit too early to announce "official nomenclature," for we, too, are trying to work out of a maze of duplication, poor descriptions and misunderstandings. The geologists writing our reports consult constantly with us and with others in their selection of names, and those names used in these reports are deemed most appropriate and valid by the individual on the basis of his consultations and information available to him at the time. It has been our policy to consult with and to inform the Geologic Names Committee, U. S. Geological Survey, of which George V. Cohee is Chairman. Such matters deal with opinions on stratigraphy, clearing and reservations of new names, and advice on revisions in nomenclature or rank.

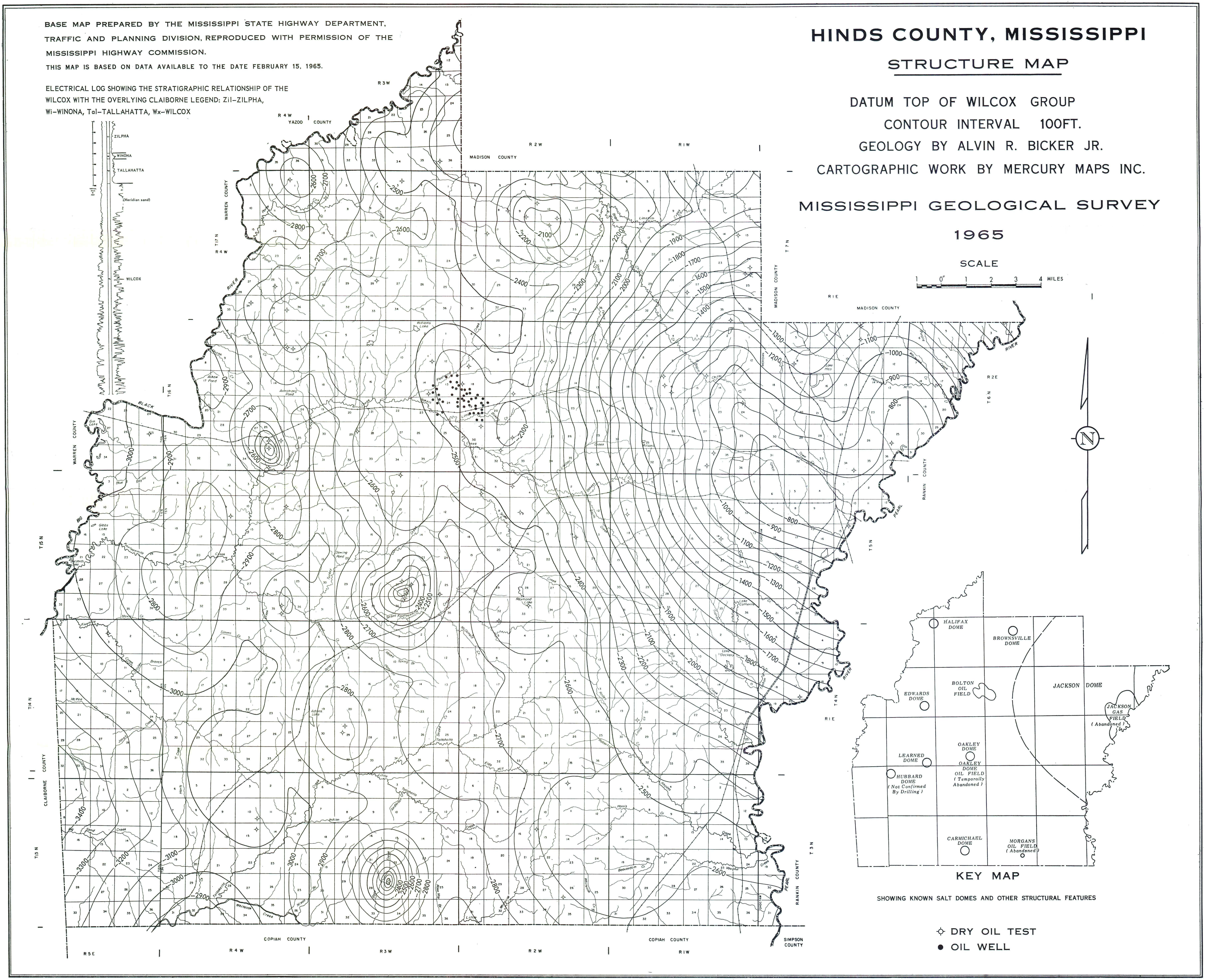
The Staff

Mississippi Geological Survey

March 1, 1963


BASE MAP PREPARED BY THE MISSISSIPPI STATE HIGHWAY DEPARTMENT, TRAFFIC AND PLANNING DIVISION, REPRODUCED WITH PERMISSION OF THE MISSISSIPPI HIGHWAY COMMISSION.
HINDS COUNTY MISSISSIPPI
GEOLOGIC MAP
GEOLOGY BY WILLIAM H. MOORE
CARTOGRAPHIC WORK BY MERCURY MAPS INC.
MISSISSIPPI GEOLOGICAL SURVEY
1965
SCALE
1 0 1 2 3 4 MILES
Quaternary
Pleistocene
Loess – brown to tan silt, land snail shells; indicates area within which loess is generally thicker than ten feet.
Qt
Pre-loess terrace deposits – fine-to coarse-grained sand; gravel; some clay lenses.
Qpc
Citronelle formation – gravels of chert and quartz; fine-to coarse-grained sand; clay lenses.
Tertiary
Miocene
Mc
Catahoula formation – sandy silty clays; siltstones; sands with some massive indurated sandstones.
Oligocene
Ov
Vicksburg group – includes in ascending order: Mint Spring sandy marls and limy sand; Glendon limestones and marls; Byram clayey marl; Bucatunna dark-gray calcareous clay.
Of
Forest Hill formation – fine-grained silty sands; silty, carbonaceous clay; lignite.
Eocene
Ey
Yazoo formation – blue-green calcareous fossiliferous clay, weathers to greenish-yellow, very limy, glauconitic near base, slumps badly.
Emb
Moodys Branch formation – limy glauconitic fossiliferous sand and sandy marl.
Ec
Cockfield formation – silty clay; very fine-to fine-grained sand; lignite.
Observed contact.
Approximate or inferred contact.
Concealed contact.
YAZOO COUNTY
MADISON COUNTY
WARREN COUNTY
CLAIBORNE COUNTY
COPIAH COUNTY
RANKIN COUNTY
SIMPSON COUNTY
BLACK RIVER
PEARL RIVER
R 5 E
R 4 W
R 3 W
R 2 W
R 1 W
R 1 E
R 2 E
T 7 N
T 6 N
T 5 N
T 4 N
T 3 N
T 17 N
T 16 N
T 15 N
T 14 N
T 13 N


HINDS COUNTY, MISSISSIPPI
STRUCTURE MAP
DATUM BASE OF MIDWAY SHALE
CONTOUR INTERVAL 100FT.
GEOLOGY BY ALVIN R. BICKER JR.
CARTOGRAPHIC WORK BY MERCURY MAPS INC.
MISSISSIPPI GEOLOGICAL SURVEY
1965
SCALE
1 0 1 2 3 4 MILES
BASE MAP PREPARED BY THE MISSISSIPPI STATE HIGHWAY DEPARTMENT, TRAFFIC AND PLANNING DIVISION, REPRODUCED WITH PERMISSION OF THE MISSISSIPPI HIGHWAY COMMISSION.
THIS MAP IS BASED ON DATA AVAILABLE TO THE DATE FEBRUARY 15, 1965.
SALT DOME WITH MIDWAY AND CRETACEOUS ABSENT
DRY OIL TEST
OIL WELL
ABANDONED GAS WELL
YAZOO COUNTY
MADISON COUNTY
WARREN COUNTY
CLAIBORNE COUNTY
RANKIN COUNTY
COPIAH COUNTY
SIMPSON COUNTY
UTICA SALT DOME 2 MILES
KEY MAP TO SHOWING KNOWN SALT DOMES AND OTHER STRUCTURAL FEATURES
HALIFAX DOME
BROWNSVILLE DOME
BOLTON OIL FIELD
JACKSON DOME
JACKSON GAS FIELD (Abandoned)
EDWARDS DOME
LEARNED DOME
HUBBARD DOME (Not Confirmed By Drilling)
OAKLEY DOME
OAKLEY DOME OIL FIELD (Temporarily Abandoned)
CARMICHAEL DOME
MORGANS OIL FIELD (Abandoned)


HINDS COUNTY, MISSISSIPPI
STRUCTURE MAP
DATUM TOP OF WILCOX GROUP
CONTOUR INTERVAL 100FT.
GEOLOGY BY ALVIN R. BICKER JR.
CARTOGRAPHIC WORK BY MERCURY MAPS INC.
MISSISSIPPI GEOLOGICAL SURVEY
1965
SCALE
1 0 1 2 3 4 MILES
BASE MAP PREPARED BY THE MISSISSIPPI STATE HIGHWAY DEPARTMENT, TRAFFIC AND PLANNING DIVISION, REPRODUCED WITH PERMISSION OF THE MISSISSIPPI HIGHWAY COMMISSION.
THIS MAP IS BASED ON DATA AVAILABLE TO THE DATE FEBRUARY 15, 1965.
ELECTRICAL LOG SHOWING THE STRATIGRAPHIC RELATIONSHIP OF THE WILCOX WITH THE OVERLYING CLAIBORNE LEGEND: Zil-ZILPHA, Wi-WINONA, Tal-TALLAHATTA, Wx-WILCOX
ZILPHA
WINONA
TALLAHATTA
(Meridian sand)
WILCOX
YAZOO COUNTY
MADISON COUNTY
WARREN COUNTY
CLAIBORNE COUNTY
COPIAH COUNTY
SIMPSON COUNTY
RANKIN COUNTY
R 4 W
R 3 W
R 2 W
R 1 W
R 1 E
R 2 E
R 5 E
T 7 N
T 6 N
T 5 N
T 4 N
T 3 N
BLACK RIVER
BIG BLACK RIVER
PEARL RIVER
KEY MAP
HALIFAX DOME
BROWNSVILLE DOME
BOLTON OIL FIELD
JACKSON DOME
EDWARDS DOME
JACKSON GAS FIELD (Abandoned)
OAKLEY DOME
LEARNED DOME
OAKLEY DOME OIL FIELD (Temporarily Abandoned)
HUBBARD DOME (Not Confirmed By Drilling)
CARMICHAEL DOME
MORGANS OIL FIELD (Abandoned)
SHOWING KNOWN SALT DOMES AND OTHER STRUCTURAL FEATURES
DRY OIL TEST
OIL WELL

BASE MAP PREPARED BY THE MISSISSIPPI STATE HIGHWAY DEPARTMENT, TRAFFIC AND PLANNING DIVISION, REPRODUCED WITH PERMISSION OF THE MISSISSIPPI HIGHWAY COMMISSION.

THIS MAP IS BASED ON DATA AVAILABLE TO THE DATE FEBRUARY 15, 1965.

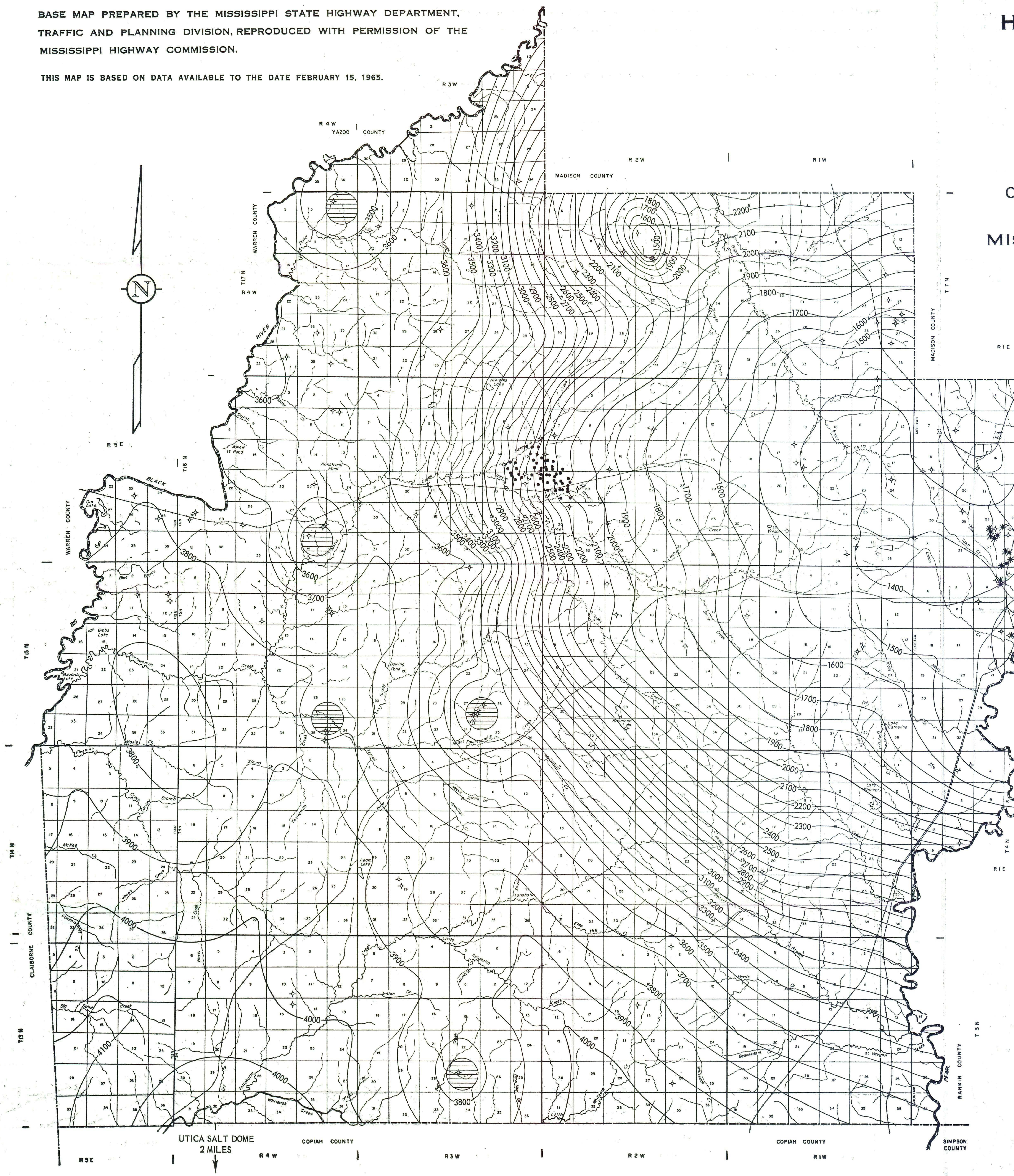
HINDS COUNTY, MISSISSIPPI

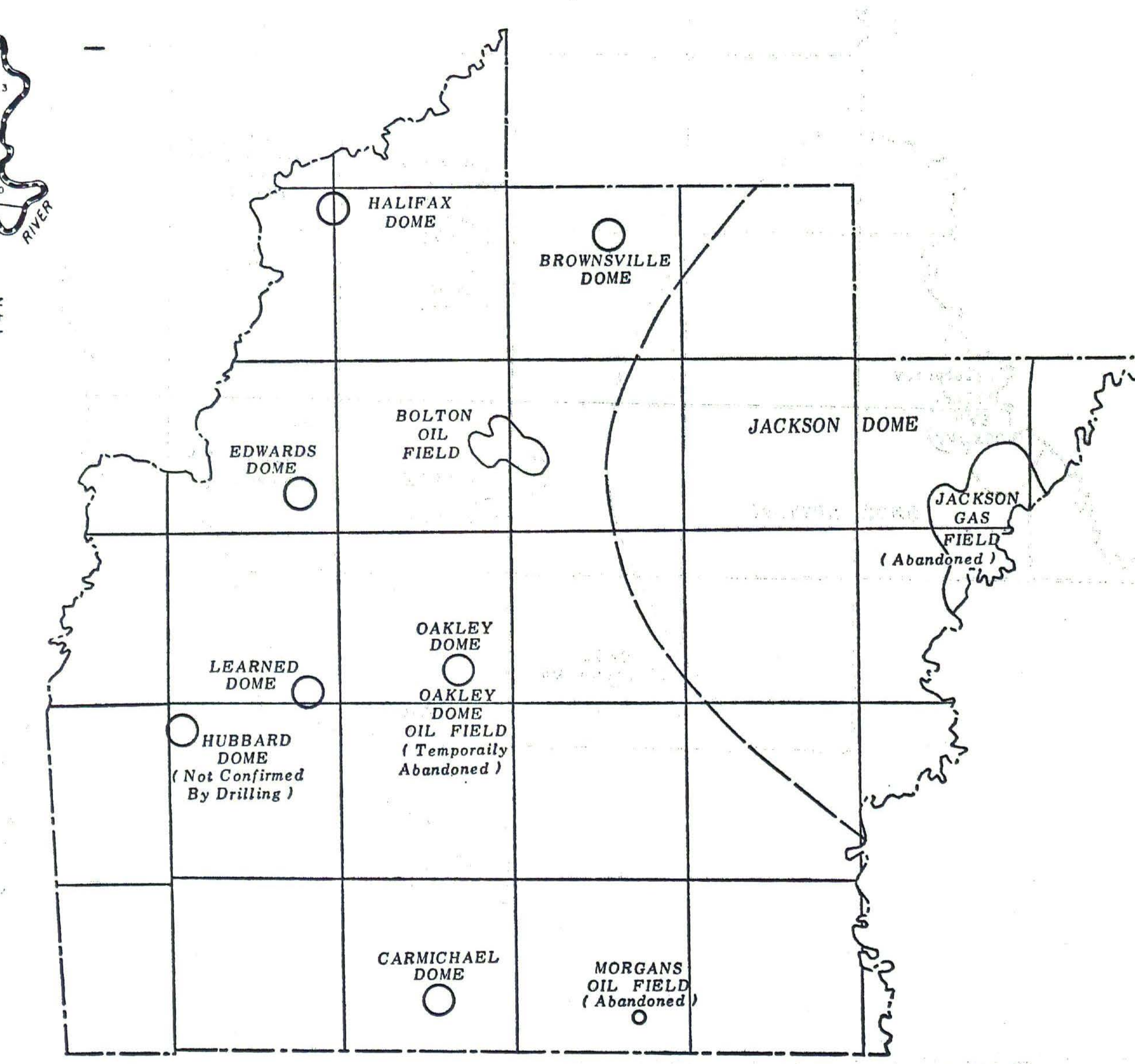
ISOPACHOUS MAP

TOP WILCOX TO BASE MIDWAY SHALE
CONTOUR INTERVAL 100FT.
GEOLOGY BY ALVIN R. BICKER JR.
CARTOGRAPHIC WORK BY MERCURY MAPS INC.

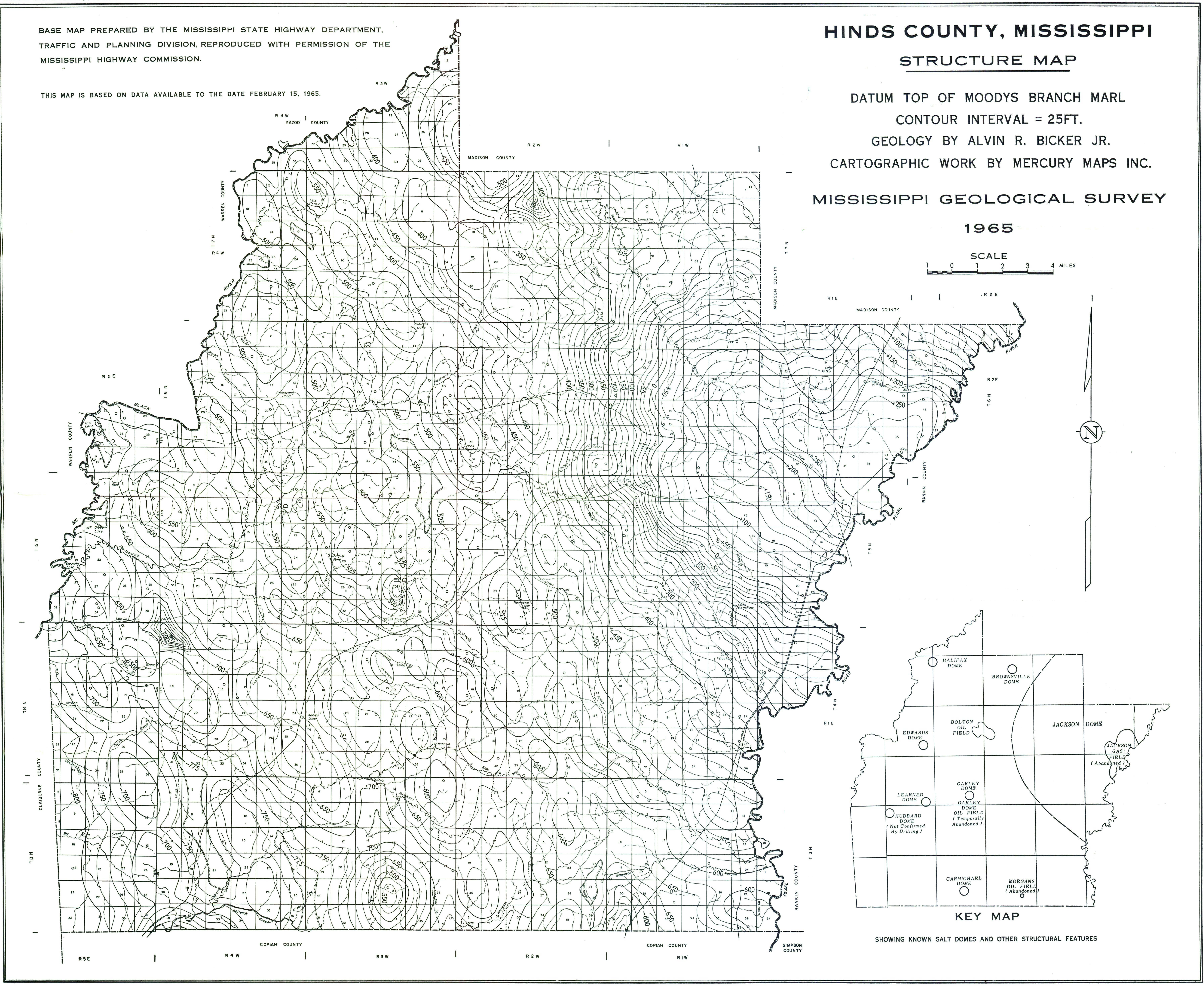
MISSISSIPPI GEOLOGICAL SURVEY

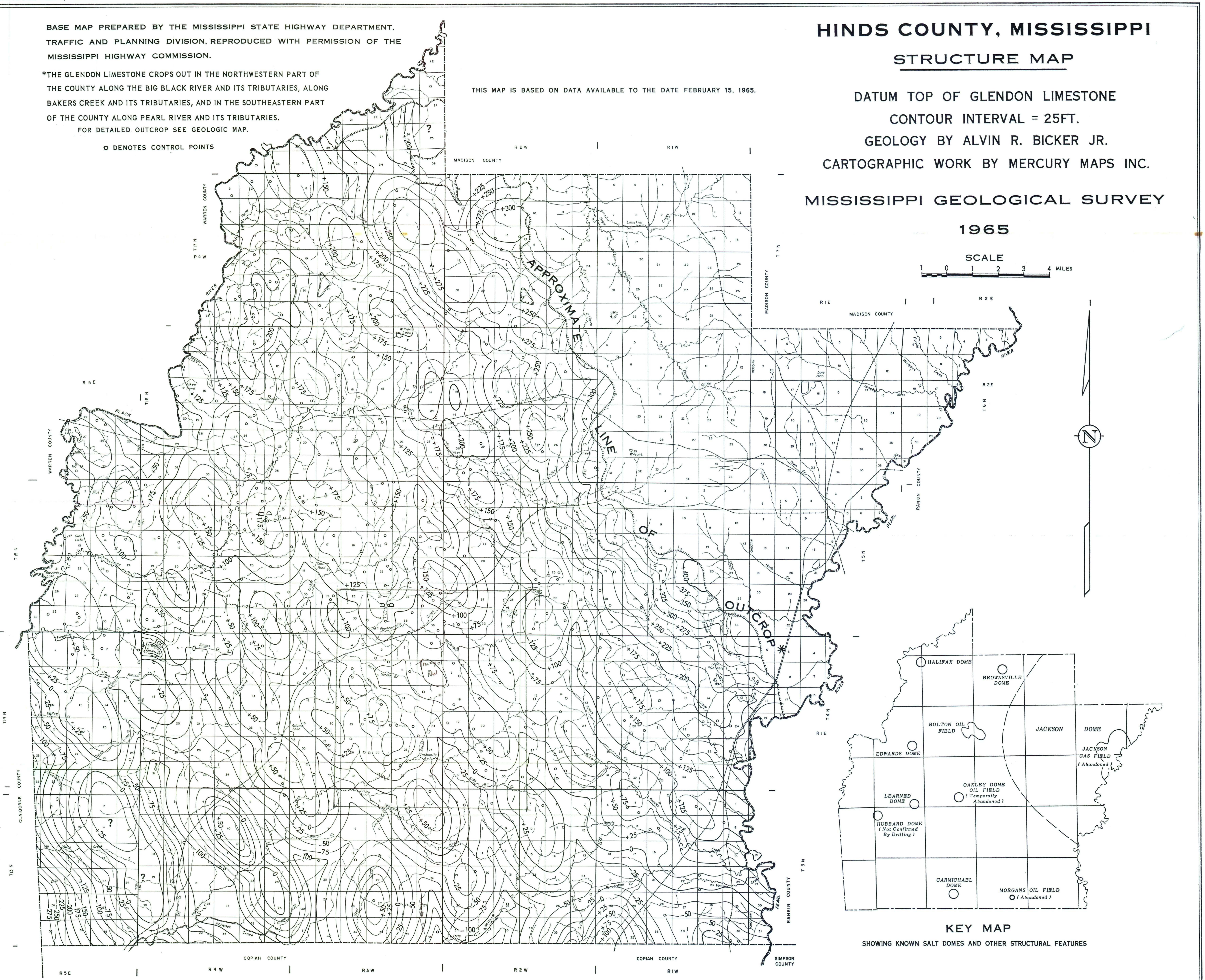
1965





KEY MAP
TO
SHOWING KNOWN SALT DOMES AND OTHER STRUCTURAL FEATURES


HINDS COUNTY, MISSISSIPPI
STRUCTURE MAP
DATUM TOP OF MOODYS BRANCH MARL
CONTOUR INTERVAL = 25FT.
GEOLOGY BY ALVIN R. BICKER JR.
CARTOGRAPHIC WORK BY MERCURY MAPS INC.
MISSISSIPPI GEOLOGICAL SURVEY
1965
BASE MAP PREPARED BY THE MISSISSIPPI STATE HIGHWAY DEPARTMENT, TRAFFIC AND PLANNING DIVISION, REPRODUCED WITH PERMISSION OF THE MISSISSIPPI HIGHWAY COMMISSION.
THIS MAP IS BASED ON DATA AVAILABLE TO THE DATE FEBRUARY 15, 1965.
SCALE
1 0 1 2 3 4 MILES
YAZOO COUNTY
MADISON COUNTY
WARREN COUNTY
RANKIN COUNTY
CLAIBORNE COUNTY
COPIAH COUNTY
SIMPSON COUNTY
R 5 E
R 4 W
R 3 W
R 2 W
R 1 W
R 1 E
R 2 E
T 17 N
T 16 N
T 15 N
T 14 N
T 13 N
T 7 N
T 6 N
T 5 N
T 4 N
T 3 N
BLACK RIVER
PEARL RIVER
KEY MAP
SHOWING KNOWN SALT DOMES AND OTHER STRUCTURAL FEATURES
HALIFAX DOME
BROWNSVILLE DOME
BOLTON OIL FIELD
EDWARDS DOME
JACKSON DOME
JACKSON GAS FIELD (Abandoned)
LEARNED DOME
OAKLEY DOME
OAKLEY DOME OIL FIELD (Temporaily Abandoned)
HUBBARD DOME (Not Confirmed By Drilling)
CARMICHAEL DOME
MORGANS OIL FIELD (Abandoned)


HINDS COUNTY, MISSISSIPPI
STRUCTURE MAP
DATUM TOP OF GLENDON LIMESTONE
CONTOUR INTERVAL = 25FT.
GEOLOGY BY ALVIN R. BICKER JR.
CARTOGRAPHIC WORK BY MERCURY MAPS INC.
MISSISSIPPI GEOLOGICAL SURVEY
1965
SCALE
1 0 1 2 3 4 MILES
BASE MAP PREPARED BY THE MISSISSIPPI STATE HIGHWAY DEPARTMENT, TRAFFIC AND PLANNING DIVISION, REPRODUCED WITH PERMISSION OF THE MISSISSIPPI HIGHWAY COMMISSION.
*THE GLENDON LIMESTONE CROPS OUT IN THE NORTHWESTERN PART OF THE COUNTY ALONG THE BIG BLACK RIVER AND ITS TRIBUTARIES, ALONG BAKERS CREEK AND ITS TRIBUTARIES, AND IN THE SOUTHEASTERN PART OF THE COUNTY ALONG PEARL RIVER AND ITS TRIBUTARIES.
FOR DETAILED OUTCROP SEE GEOLOGIC MAP.
O DENOTES CONTROL POINTS
THIS MAP IS BASED ON DATA AVAILABLE TO THE DATE FEBRUARY 15, 1965.
APPROXIMATE LINE OF OUTCROP
MADISON COUNTY
WARREN COUNTY
CLAIBORNE COUNTY
COPIAH COUNTY
RANKIN COUNTY
SIMPSON COUNTY
R5E
R4W
R3W
R2W
R1W
R1E
R2E
T7N
T6N
T5N
T4N
T3N
T17N
T16N
T15N
T14N
T13N
BIG BLACK RIVER
PEARL RIVER
N
KEY MAP
SHOWING KNOWN SALT DOMES AND OTHER STRUCTURAL FEATURES
HALIFAX DOME
BROWNSVILLE DOME
BOLTON OIL FIELD
JACKSON DOME
JACKSON GAS FIELD (Abandoned)
EDWARDS DOME
OAKLEY DOME OIL FIELD (Temporarily Abandoned)
LEARNED DOME
HUBBARD DOME (Not Confirmed By Drilling)
CARMICHAEL DOME
MORGANS OIL FIELD (Abandoned)

HINDS COUNTY, MISSISSIPPI

ISOPACHOUS MAP

GLENDON LIMESTONE TO MOODYS BRANCH MARL
CONTOUR INTERVAL 10FT.
GEOLOGY BY ALVIN R. BICKER JR.
CARTOGRAPHIC WORK BY MERCURY MAPS INC.

MISSISSIPPI GEOLOGICAL SURVEY

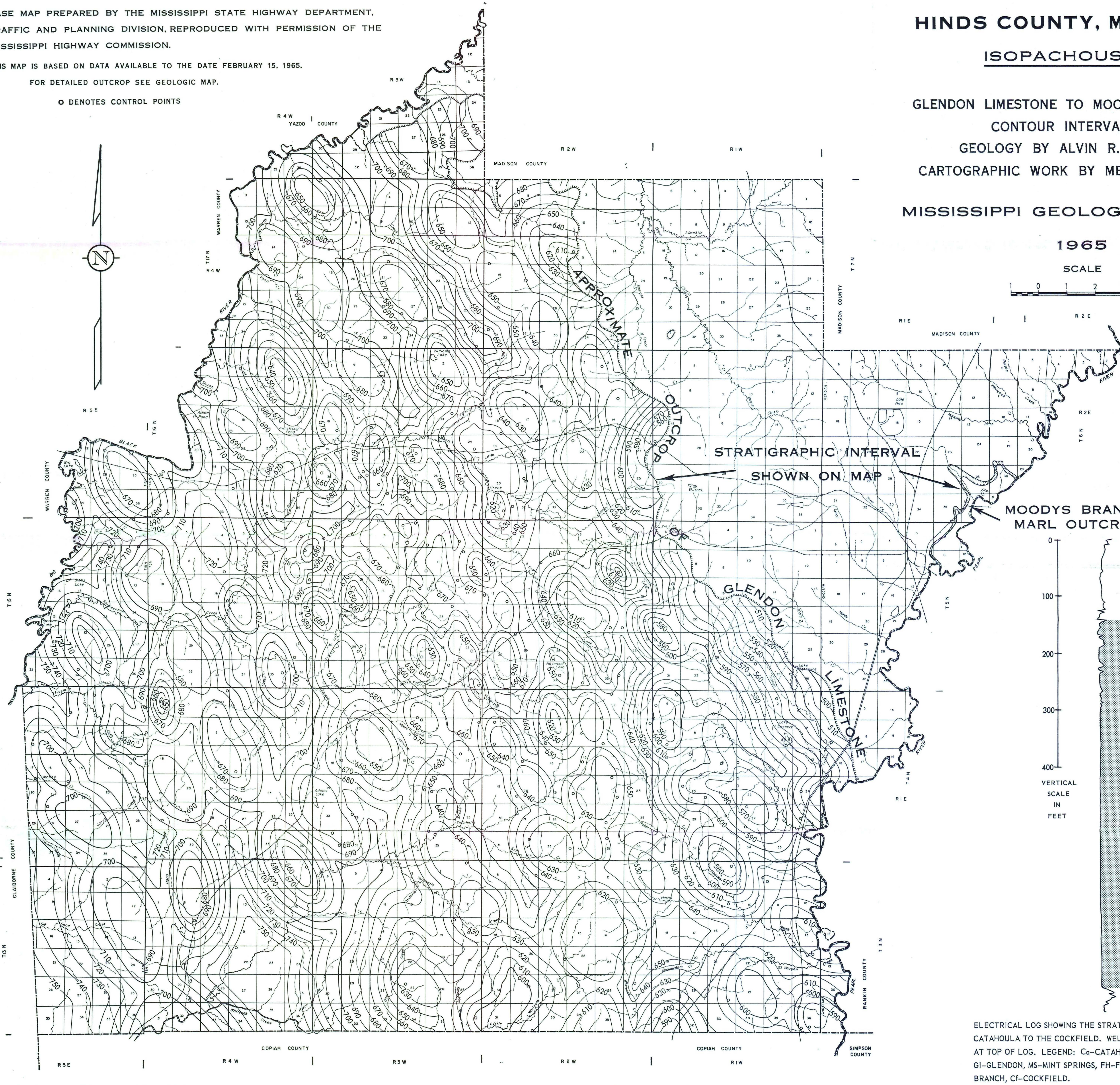
1965

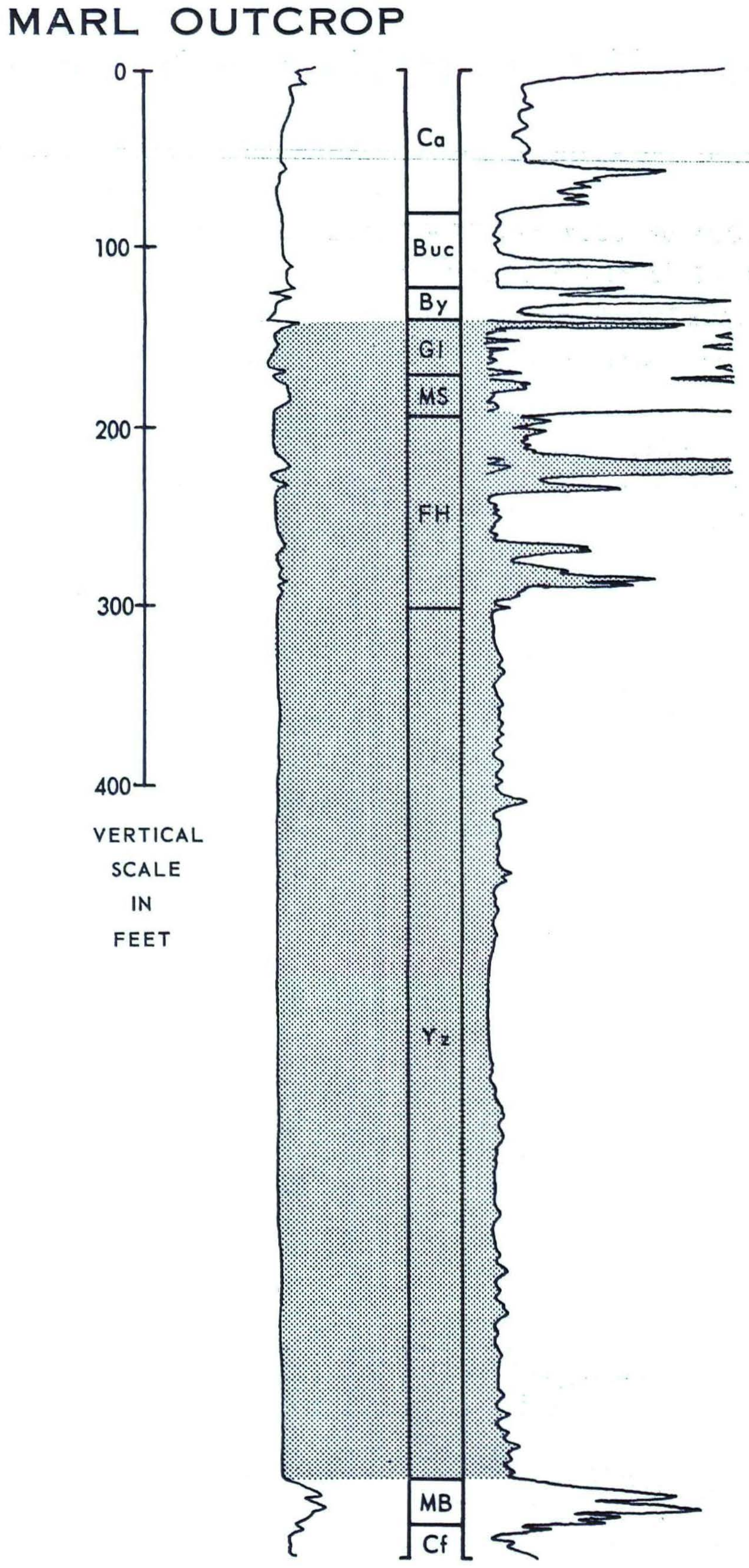
BASE MAP PREPARED BY THE MISSISSIPPI STATE HIGHWAY DEPARTMENT, TRAFFIC AND PLANNING DIVISION, REPRODUCED WITH PERMISSION OF THE MISSISSIPPI HIGHWAY COMMISSION.

THIS MAP IS BASED ON DATA AVAILABLE TO THE DATE FEBRUARY 15, 1965.

FOR DETAILED OUTCROP SEE GEOLOGIC MAP.

o DENOTES CONTROL POINTS





ELECTRICAL LOG SHOWING THE STRATIGRAPHIC INTERVAL FROM THE CATAHOULA TO THE COCKFIELD. WELL LOCATION DENOTED BY LETTER AT TOP OF LOG. LEGEND: Ca-CATAHOULA, Buc-BUCATUNNA, By-BYRAM, Gl-GLENDON, MS-MINT SPRINGS, FH-FOREST HILL, Yz-YAZOO, MB-MOODYS BRANCH, Cf-COCKFIELD.

HINDS COUNTY, MISSISSIPPI

ISOPACHOUS MAP

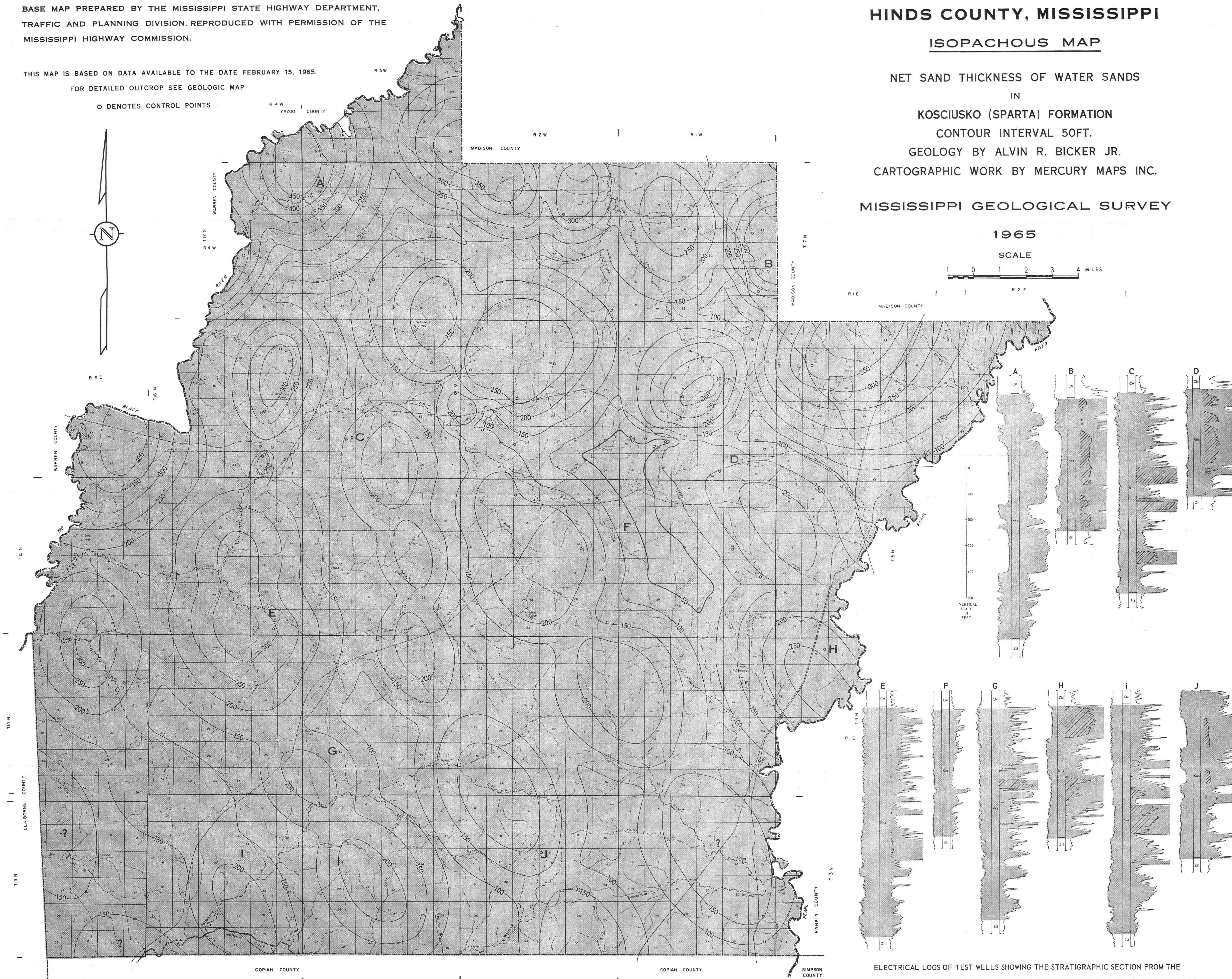
NET SAND THICKNESS OF WATER SANDS
IN
KOSCIUSKO (SPARTA) FORMATION
CONTOUR INTERVAL 50FT.
GEOLOGY BY ALVIN R. BICKER JR.
CARTOGRAPHIC WORK BY MERCURY MAPS INC.

MISSISSIPPI GEOLOGICAL SURVEY

1965

BASE MAP PREPARED BY THE MISSISSIPPI STATE HIGHWAY DEPARTMENT, TRAFFIC AND PLANNING DIVISION, REPRODUCED WITH PERMISSION OF THE MISSISSIPPI HIGHWAY COMMISSION.

THIS MAP IS BASED ON DATA AVAILABLE TO THE DATE FEBRUARY 15, 1965.
FOR DETAILED OUTCROP SEE GEOLOGIC MAP
o DENOTES CONTROL POINTS



ELECTRICAL LOGS OF TEST WELLS SHOWING THE STRATIGRAPHIC SECTION FROM THE COOK MOUNTAIN TO THE ZILPHA. WELL LOCATIONS DENOTED BY LETTER AT TOP OF LOG.
LEGEND– CM– COOK MOUNTIAN, Kos– KOSCIUSKO, Zil– ZILPHA.

HINDS COUNTY, MISSISSIPPI

ISOPACHOUS MAP

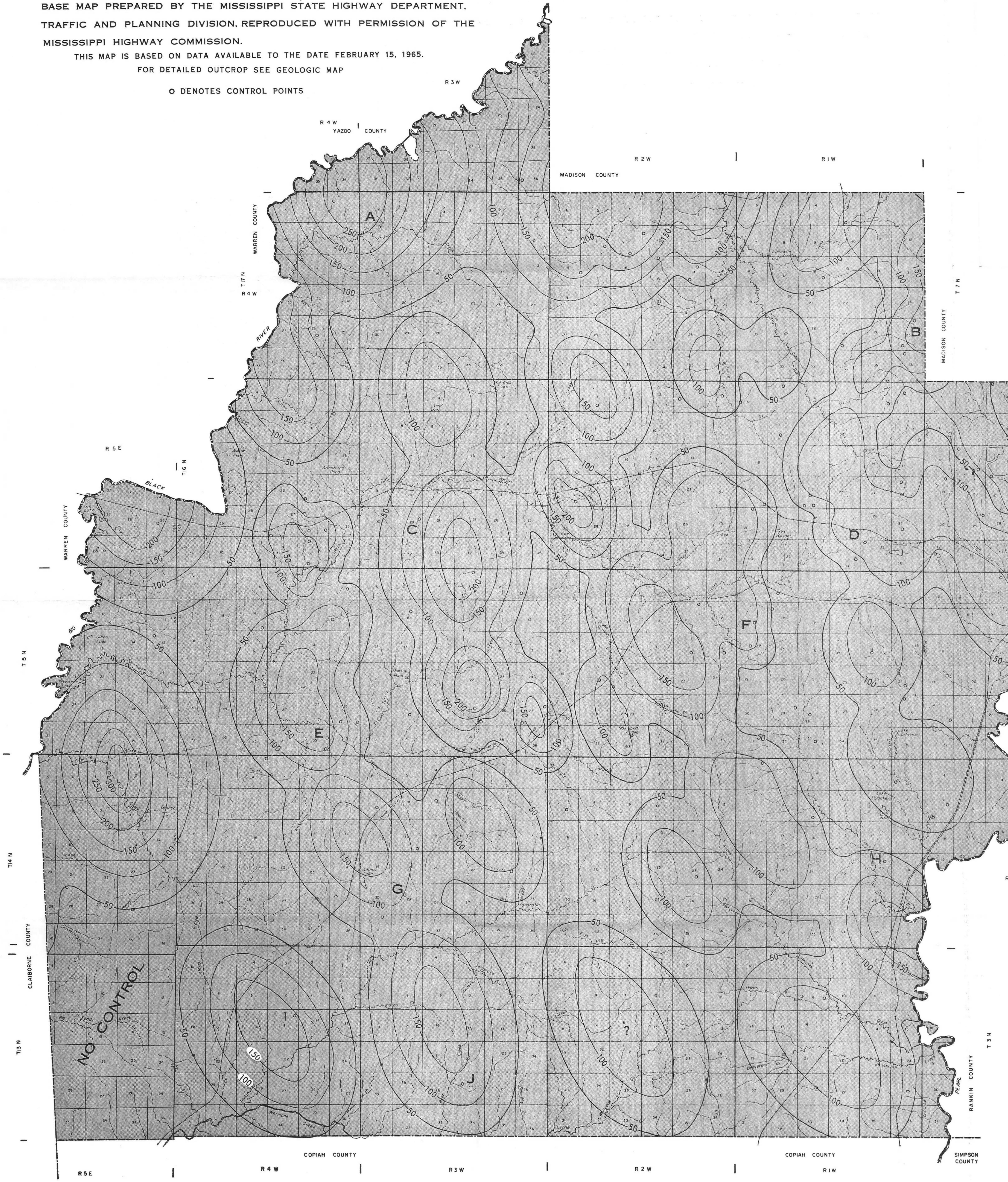
NET SAND THICKNESS OF WATER SANDS
IN
COCKFIELD FORMATION
CONTOUR INTERVAL 50FT.
GEOLOGY BY ALVIN R. BICKER JR.
CARTOGRAPHIC WORK BY MERCURY MAPS INC.

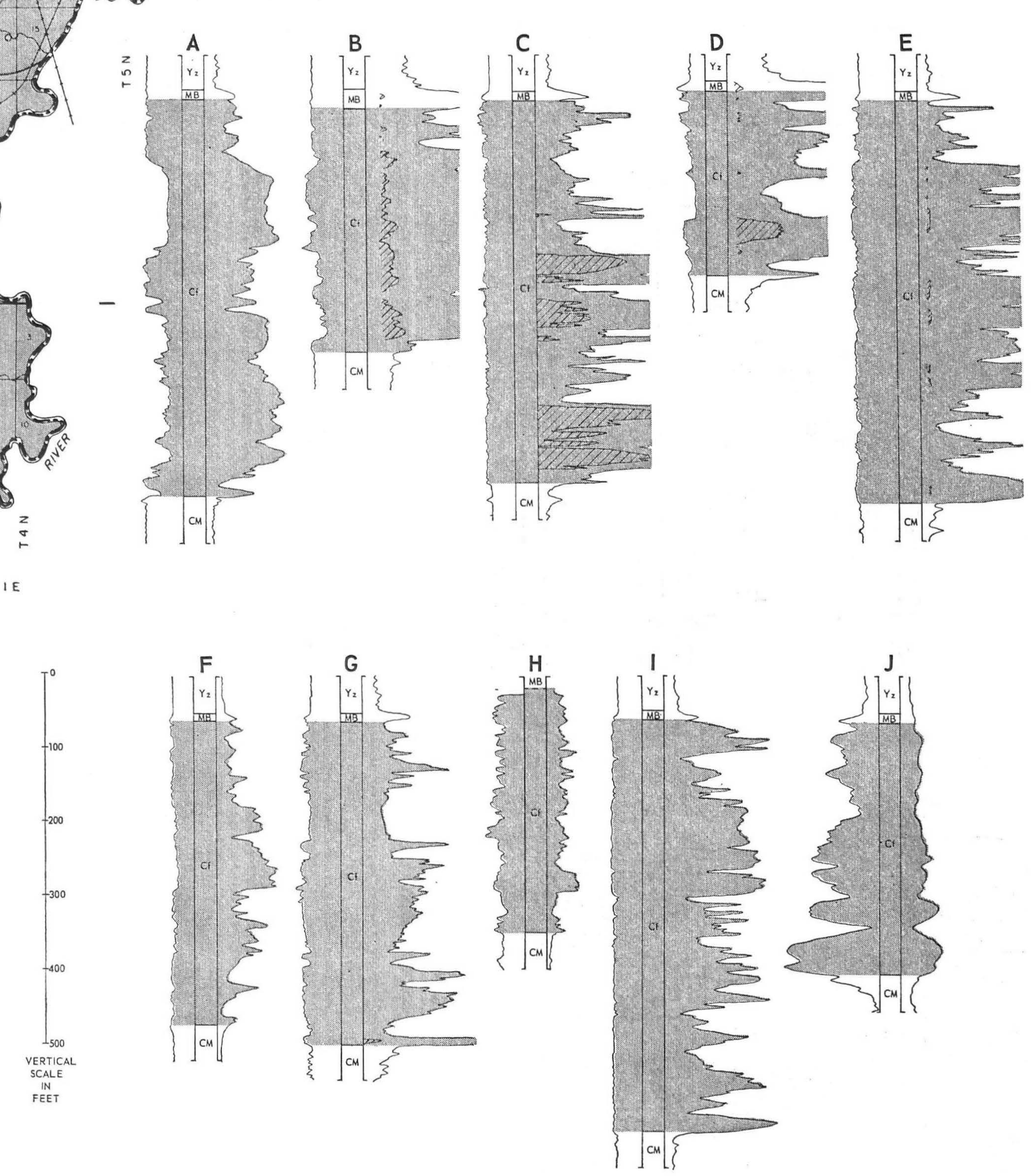
MISSISSIPPI GEOLOGICAL SURVEY

1965

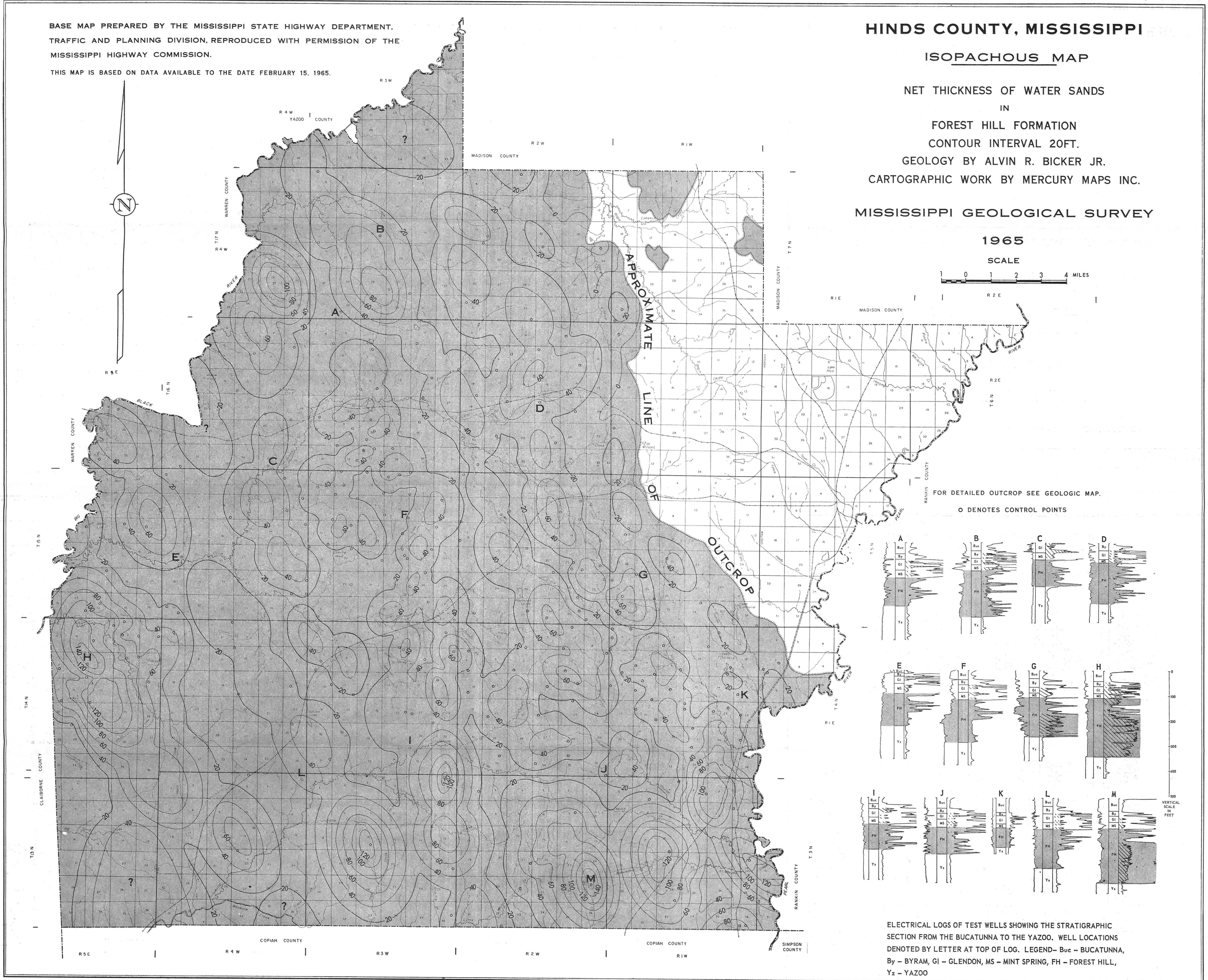
BASE MAP PREPARED BY THE MISSISSIPPI STATE HIGHWAY DEPARTMENT, TRAFFIC AND PLANNING DIVISION, REPRODUCED WITH PERMISSION OF THE MISSISSIPPI HIGHWAY COMMISSION.
THIS MAP IS BASED ON DATA AVAILABLE TO THE DATE FEBRUARY 15, 1965.
FOR DETAILED OUTCROP SEE GEOLOGIC MAP

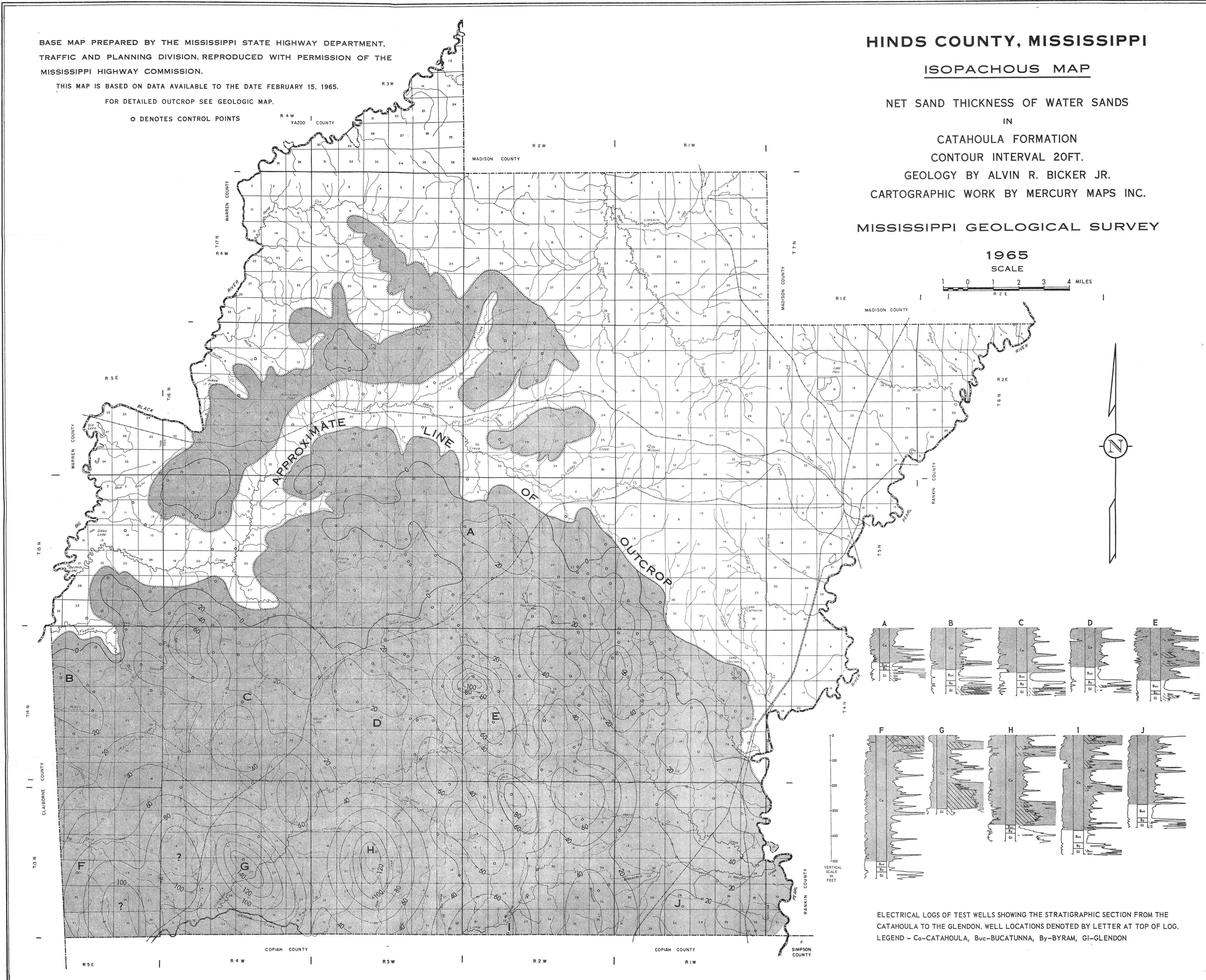
O DENOTES CONTROL POINTS

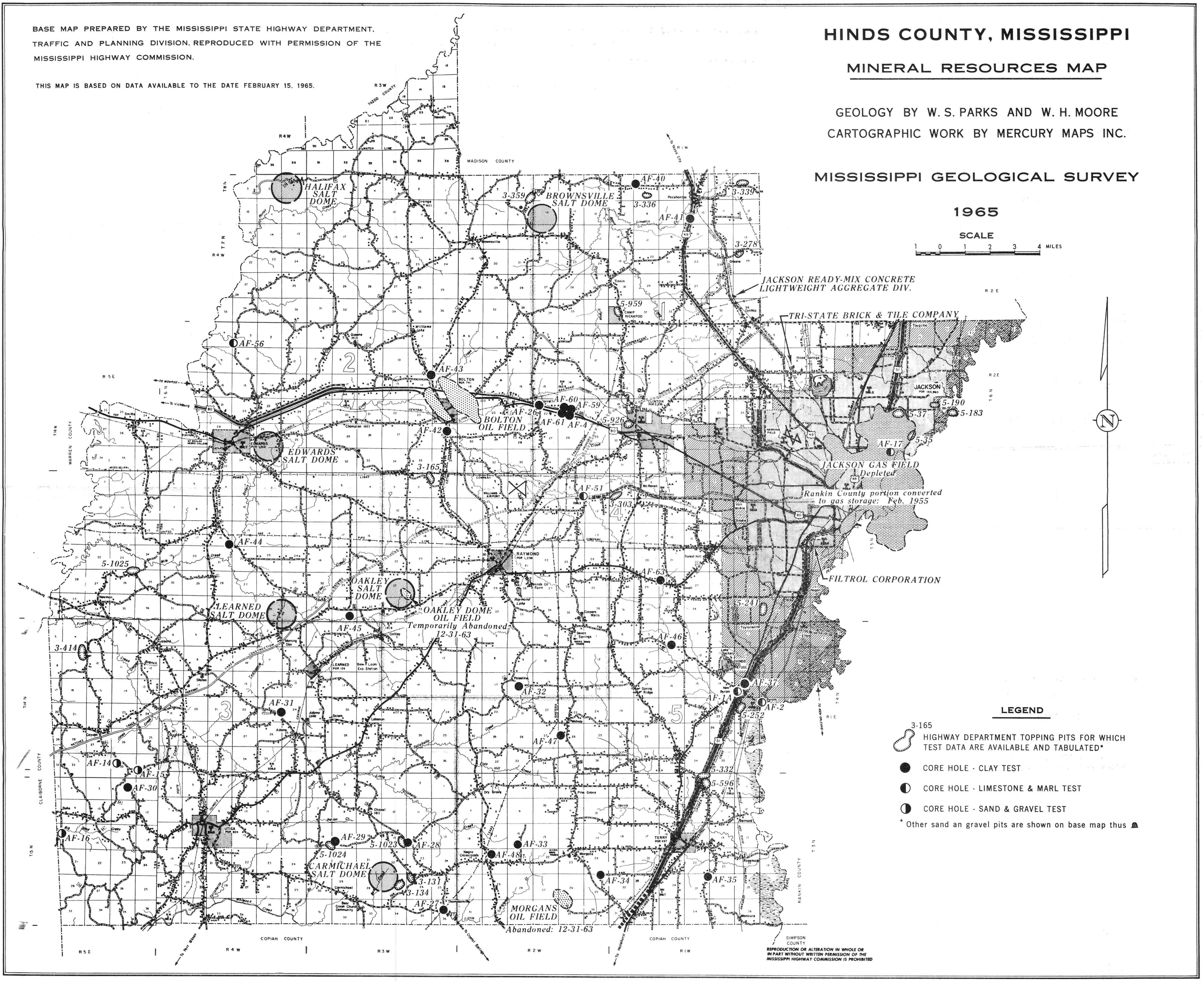




ELECTRICAL LOGS OF TEST WELLS SHOWING THE STRATIGRAPHIC SECTION FROM THE YAZOO TO THE COOK MOUNTAIN. WELL LOCATIONS DENOTED BY LETTER AT TOP OF LOG.
LEGEND– Yz– YAZOO, MB– MOODYS BRANCH, Cf– COCKFIELD, CM– COOK MOUNTAIN.


HINDS COUNTY, MISSISSIPPI
ISOPACHOUS MAP
NET THICKNESS OF WATER SANDS
IN
FOREST HILL FORMATION
CONTOUR INTERVAL 20FT.
GEOLOGY BY ALVIN R. BICKER JR.
CARTOGRAPHIC WORK BY MERCURY MAPS INC.
MISSISSIPPI GEOLOGICAL SURVEY
1965
SCALE
1 0 1 2 3 4 MILES
BASE MAP PREPARED BY THE MISSISSIPPI STATE HIGHWAY DEPARTMENT, TRAFFIC AND PLANNING DIVISION, REPRODUCED WITH PERMISSION OF THE MISSISSIPPI HIGHWAY COMMISSION.
THIS MAP IS BASED ON DATA AVAILABLE TO THE DATE FEBRUARY 15, 1965.
APPROXIMATE LINE OF OUTCROP
FOR DETAILED OUTCROP SEE GEOLOGIC MAP.
O DENOTES CONTROL POINTS
YAZOO COUNTY
MADISON COUNTY
WARREN COUNTY
CLAIBORNE COUNTY
COPIAH COUNTY
RANKIN COUNTY
SIMPSON COUNTY
BLACK RIVER
BIG BLACK RIVER
PEARL RIVER
R 5 E
R 4 W
R 3 W
R 2 W
R 1 W
R 1 E
R 2 E
T 7 N
T 6 N
T 5 N
T 4 N
T 3 N
VERTICAL SCALE IN FEET
ELECTRICAL LOGS OF TEST WELLS SHOWING THE STRATIGRAPHIC SECTION FROM THE BUCATUNNA TO THE YAZOO. WELL LOCATIONS DENOTED BY LETTER AT TOP OF LOG. LEGEND- Buc – BUCATUNNA, By – BYRAM, Gl – GLENDON, MS – MINT SPRING, FH – FOREST HILL, Yz – YAZOO


BASE MAP PREPARED BY THE MISSISSIPPI STATE HIGHWAY DEPARTMENT, TRAFFIC AND PLANNING DIVISION, REPRODUCED WITH PERMISSION OF THE MISSISSIPPI HIGHWAY COMMISSION.
THIS MAP IS BASED ON DATA AVAILABLE TO THE DATE FEBRUARY 15, 1965.
FOR DETAILED OUTCROP SEE GEOLOGIC MAP.
O DENOTES CONTROL POINTS
HINDS COUNTY, MISSISSIPPI
ISOPACHOUS MAP
NET SAND THICKNESS OF WATER SANDS
IN
CATAHOULA FORMATION
CONTOUR INTERVAL 20FT.
GEOLOGY BY ALVIN R. BICKER JR.
CARTOGRAPHIC WORK BY MERCURY MAPS INC.
MISSISSIPPI GEOLOGICAL SURVEY
1965
SCALE
1 0 1 2 3 4 MILES
APPROXIMATE LINE OF OUTCROP
YAZOO COUNTY
MADISON COUNTY
WARREN COUNTY
CLAIBORNE COUNTY
COPIAH COUNTY
RANKIN COUNTY
SIMPSON COUNTY
BLACK RIVER
BIG BLACK RIVER
PEARL RIVER
R 5 E
R 4 W
R 3 W
R 2 W
R 1 W
R 1 E
R 2 E
T 17 N
T 16 N
T 15 N
T 14 N
T 13 N
T 7 N
T 6 N
T 5 N
T 4 N
N
ELECTRICAL LOGS OF TEST WELLS SHOWING THE STRATIGRAPHIC SECTION FROM THE CATAHOULA TO THE GLENDON. WELL LOCATIONS DENOTED BY LETTER AT TOP OF LOG.
LEGEND – Ca–CATAHOULA, Buc–BUCATUNNA, By–BYRAM, Gl–GLENDON
VERTICAL SCALE IN FEET


BASE MAP PREPARED BY THE MISSISSIPPI STATE HIGHWAY DEPARTMENT, TRAFFIC AND PLANNING DIVISION, REPRODUCED WITH PERMISSION OF THE MISSISSIPPI HIGHWAY COMMISSION.
THIS MAP IS BASED ON DATA AVAILABLE TO THE DATE FEBRUARY 15, 1965.
HINDS COUNTY, MISSISSIPPI
MINERAL RESOURCES MAP
GEOLOGY BY W. S. PARKS AND W. H. MOORE
CARTOGRAPHIC WORK BY MERCURY MAPS INC.
MISSISSIPPI GEOLOGICAL SURVEY
1965
SCALE
1 0 1 2 3 4 MILES
LEGEND
3-165
HIGHWAY DEPARTMENT TOPPING PITS FOR WHICH TEST DATA ARE AVAILABLE AND TABULATED*
CORE HOLE - CLAY TEST
CORE HOLE - LIMESTONE & MARL TEST
CORE HOLE - SAND & GRAVEL TEST
* Other sand an gravel pits are shown on base map thus
HALIFAX SALT DOME
BROWNSVILLE SALT DOME
EDWARDS SALT DOME
OAKLEY SALT DOME
LEARNED SALT DOME
CARMICHAEL SALT DOME
BOLTON OIL FIELD
OAKLEY DOME OIL FIELD
Temporarily Abandoned 12-31-63
MORGANS OIL FIELD
Abandoned: 12-31-63
JACKSON GAS FIELD
Depleted
Rankin County portion converted to gas storage: Feb. 1955
JACKSON READY-MIX CONCRETE LIGHTWEIGHT AGGREGATE DIV.
TRI-STATE BRICK & TILE COMPANY
FILTROL CORPORATION
MADISON COUNTY
WARREN COUNTY
CLAIBORNE COUNTY
COPIAH COUNTY
RANKIN COUNTY
SIMPSON COUNTY
JACKSON
RAYMOND
UTICA
TERRY
BOLTON
CLINTON
EDWARDS
LEARNED
REPRODUCTION OR ALTERATION IN WHOLE OR IN PART WITHOUT WRITTEN PERMISSION OF THE MISSISSIPPI HIGHWAY COMMISSION IS PROHIBITED