Mississippi State Geological Survey

ALBERT F. CRIDER, DIRECTOR.

BULLETIN No. 4

CLAYS OF MISSISSIPPI

PART II.

Brick Clays and Clay Industry of Southern Mississippi

By WILLIAM N. LOGAN

1908

BRANDON-NASHVILLE

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STATE GEOLOGICAL COMMISSION.

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E. N. Lowe.....*Assistant Geologist*

LETTER OF TRANSMITTAL.

Governor E. F. Noel, Chairman, and Members of the Geological Commission:

GENTLEMEN:—I submit herewith a report on the brick clays of southern Mississippi, prepared by Dr. W. N. Logan, and recommend that it be printed as Bulletin No. 4. A report on the brick clays of northern Mississippi was published in 1907 as Bulletin No. 2. In that report considerable attention was given to the origin and technology of clays as well as to the status of the brick industry of northern Mississippi. Bulletin No. 4 completes the study of the brick clays of the State and should be read in connection with Bulletin No. 2.

The common brick clays contribute largely to the industrial development of the State, and their importance will become greater year by year as the valuable timber becomes scarce.

Dr. Logan has pointed out in his report that the brick industry, especially in southern Mississippi, is yet in its infancy. Many of the plants are small and rather crude methods are employed in the manufacture of brick. This condition will gradually change for the better as the demand for brick increases. In most of the large towns up-to-date plants have been erected to meet the growing demands for a substantial building material.

The brick clays of southern Mississippi, east of Pearl River are, as a general rule, more difficult to handle than those west of Pearl River and in northern Mississippi. Some of the plants have suspended operations because it is so difficult to dry and burn the brick without cracking. As pointed out by Dr. Logan, this trouble can be largely overcome by mixing the tough plastic clay with coarse, sharp sand, and storing the mixture in covered sheds and allowing it to weather thoroughly before using.

Very respectfully,

A. F. CRIDER, *Director.*

Jackson, Mississippi, August 1, 1908.

TABLE OF CONTENTS.

LIST OF ILLUSTRATIONS.

LIST OF TABLES.

INTRODUCTION.

In the year 1906 the writer began the investigation of the brick-clays of Mississippi in connection with the State Geological Survey. The work of the first season was confined to the territory lying north of the Alabama and Vicksburg Railroad. The results of these investigations were published in 1907 in a report entitled, "Brick Clays and Clay Industry of Northern Mississippi." The report includes a discussion of the technology of clays; a report on the geology of clays, and also a discussion of the brick industry of northern Mississippi.

The present report includes a discussion of the geology of the brick-clays and clay industry in the counties lying south of the Alabama and Vicksburg Railroad. The brick industry in many of these counties is either entirely undeveloped or only in an experimental stage. In some of the counties, however, bricks have been manufactured successfully for many years. As this section of the State is undergoing a rapid industrial development, and as it is dependent largely upon brick for building material of a more permanent class, we may expect that the brick industry in southern Mississippi will be greatly developed in the near future. This preliminary report should be read in connection with the one mentioned above.

The counties which are included in the report are as follows:

Adams	Franklin	Jefferson Davis	Pearl River
Amite	Greene	Jones	Pike
Claiborne	Hancock	Lamar	Simpson
Clarke	Harrison	Lawrence	Smith
Copiah	Jackson	Lincoln	Wayne
Covington	Jasper	Marion	Wilkinson
Forrest	Jefferson	Perry	

GEOLOGICAL FORMATIONS.

The geological formations of southern Mississippi are the Claiborne, the Jackson, the Vicksburg, the Grand Gulf (including the Pascagoula), the Lafayette, the Port Hudson, the Loess and the Columbia.

Claiborne.—The outcrop of the Claiborne extends in a belt across the State, the northern boundary running from the northern part of

Clarke County to the southern part of Grenada County. The width of the outcrop increases toward the northwest. West of Grenada County the formation is concealed by the alluvial deposits of the Yazoo basin, and it has never been found in the hills north of Grenada County.

The Claiborne represents one of the stages of the Eocene epoch of the Tertiary period. In Mississippi the Claiborne has been divided into the Tallahatta buhrstone, the Lisbon and the undifferentiated Claiborne.

The Tallahatta buhrstone consists, in some localities, of hard, white sandstones and claystones. In other localities the formation is composed largely of ferruginous sands but slightly cemented, and containing numerous fossils. In some places the rocks are cherty in character, with layers of chert interbedded with sandy clays.

The Lisbon formation consists of sands, usually white, containing calcareous material. The formation also contains greenish-colored marls and lignitic clays. The marls are usually decidedly fossiliferous. For the chemical composition of these clays see "Geology" of Clarke County.

The undifferentiated Claiborne consists of marls, sands and clays.

Jackson.—The Jackson formation is composed largely of clays, marls and sands. The clays usually contain crystals of selenite in considerable abundance. These clays contain, in places, the remains of a large, extinct, sea-animal, called the Zeuglodon. The sands of the Jackson are interbedded with beds of lignite or lignitic clays. The outcrops of the Jackson and the overlying Vicksburg form what is known as the "Central Prairie" belt of the State. The area of outcrop of the Jackson is broader than that of the Lisbon, which lies to the north.

Vicksburg.—The Vicksburg formation forms a narrow belt of outcrop on the southern margin of the Jackson outcrop. It consists of layers of compact limestone intercalated and interstratified with beds of marl and clay. The limestone and the marl are usually fossiliferous.

Grand Gulf (including Pascagoula).—The Grand Gulf forms the bed-rock for the greater part of southern Mississippi. The formation consists of gray, argillaceous sands and sandstones, white quartz-rocks, gravels and clays. The clays contain considerable organic

matter and are dark in color in some areas. In some exposures white chalk-like clays occur. The lower portion of the formation has been called the Pascagoula by Smith and Johnson of the Alabama Survey.

Lafayette.—The principal mantle-rock of southern Mississippi belongs to the Lafayette formation. The bed-rock is everywhere mantled with Lafayette, except where it has been removed by erosion. The formation consists of rounded quartz-pebbles, cherts, mottled clays and bright-red or orange sands, usually cross-bedded and lying unconformably upon the older formations.

Loess.—The loess is a mantle-rock formation, forming a narrow belt of territory along the Mississippi River and overlying the Lafayette. It exceeds one hundred feet in thickness in some places. It thins rapidly as the distance from the river increases. The loess is composed of a fine brown silt which contains irregular concretions of lime and numerous gastropod shells. It forms a large portion of the bluffs at Natchez and other points along the border of the Mississippi flood-plain.

Columbia.—Overlying the loess and the Lafayette is a brown or yellow loam which rests unconformably upon these two formations. The upper portion of the formation is generally a sandy loam or silt. The lower portion contains a higher per cent of clay substance. The thickness of the formation rarely exceeds ten or fifteen feet. The origin of these loams is doubtful. In many places they seem to be only a residual deposit formed on the Lafayette or the loess. The brown loam, which rests upon the surface of the latter, is very similar to it in many respects.

Port Hudson.—The Port Hudson formation consists of beds of sand, marls and clays. It may be of equivalent age with the Columbia, but representing a marine phase of that formation. The term Ponchartrain has been applied to a bed of clay which is probably of the same age. These clays are typically exposed around Lake Ponchartrain and extend along the Coast. The formation also extends up the Mississippi probably to near the Mississippi-Louisiana State line.

Recent Alluvium.—Alluvial silts, sands and clays are found in beds of considerable thickness along the flood-plains of the rivers, particularly is this true of the Mississippi, the Pearl and the Pascagoula.

Near the courses of the streams sands and sandy loams were

deposited by the swifter waters of the streams. In the inter-stream areas of the flood-plains, where the over-flow water had little velocity, clays and fine silts were deposited. The clays are generally waxy and of fine texture. In drying they shrink into cuboidal forms which have considerable space between each cube. In undrained areas they contain iron concretions called "buckshot."

CLAY-BEARING FORMATIONS.

The principal clay-bearing formations of southern Mississippi are the Jackson, the Grand Gulf, the Lafayette, the Columbia (yellow and brown loams) and the river alluvium.

Jackson Clays.—The clays of the Jackson formation are represented by numerous outcrops in the so-called "Central Prairie" belt of the State. The unweathered clays are usually bluish-green; where they are exposed for a period of time they change to a pale yellow. In some outcrops crystals of selenite are abundant. When sufficiently weathered and properly tempered the Jackson clays may be used successfully in the manufacture of brick by either the stiff-mud or the soft-mud process. The following table shows the average chemical composition of three samples of Jackson clay:

TABLE No. 1.

AVERAGE ANALYSIS OF JACKSON CLAYS.

Moisture (H_2O)	5.09
Volatile matter (CO_2, etc.)	6.72
Silicon dioxide (SiO_2)	60.25
Aluminum oxide (Al_2O_3)	12.65
Iron oxide (Fe_2O_3)	5.54
Calcium oxide (CaO)	6.69
Magnesium oxide (MgO)	.58
Sulphur trioxide (SO_3)	.40
Total	97.92

The average amount of clay substance in these samples is about 32 per cent. The amount of sand contained in the clay is nearly 41 per cent.

Grand Gulf Clays.—The unweathered clays of the Grand Gulf are usually gray, with a greenish cast. The weathered clays are red, yellow and mottled, though in some outcrops they are chalk-white. They are usually fine of grain and contain a large per cent of finely divided sand. Some of the Grand Gulf clays, after being thoroughly weathered, are adapted to the manufacture of brick by any of the processes of manufacture. However, on account of the minute size of the constituent

particles, the successful drying of some of the clays is attended with difficulties that are hard to overcome. Nearly all the clays of the formation dry slowly. In some localities the unweathered clays contain considerable quantities of iron pyrites. During the process of weathering the iron is either changed to the sulphate form and leached out, or it is oxidized. Gypsum, which is present in considerable abundance in some exposures, is also removed by the solvent action of water in weathering. The average chemical composition of four samples of Grand Gulf clay is given in the following table:

TABLE No. 2.

AVERAGE ANALYSIS OF GRAND GULF CLAYS.

Moisture (H_2O)	1.92
Volatile matter (CO_2, etc.)	3.31
Silicon dioxide (SiO_2)	74.48
Aluminum oxide (Al_2O_3)	10.11
Iron oxide (Fe_2O_3)	4.59
Calcium oxide (CaO)	.46
Magnesium oxide (MgO)	.40
Sulphur trioxide (SO_3)	2.18
Total	97.45

The average amount of clay substance in these clays is 25.57 per cent. The amount of sand contained is 59.02 per cent.

Lafayette Clays.—The Lafayette formation mantles the older formations in southern Mississippi. At the base of the formation in many places are beds of clays which are suitable for the manufacture of brick. These clays are usually plastic and easily molded. In some outcrops they contain too much gravel to be used with success in the manufacture of stiff-mud brick. The clay dries more rapidly around the pebbles which interfere with the wires in cutting. The clay is generally best handled by the soft-mud process. The analysis of a sandy type of Lafayette clay is given below:

TABLE No. 3.

ANALYSIS OF A SANDY, LAFAYETTE CLAY.

Moisture (H_2O)	2.23
Volatile matter (CO_2, etc.)	3.90
Silicon dioxide (SiO_2)	79.85
Aluminum oxide (Al_2O_3)	2.60
Iron oxide (Fe_2O_3)	3.75
Calcium oxide (CaO)	1.00
Magnesium oxide (MgO)	.15
Sulphur trioxide (SO_3)	.19
Total	93.97

The amount of clay substance in this sample is very small, only 6.58 per cent. About three-fourths of the contents of the clay are sand.

The bonding power of such a clay is necessarily low. Some of the clays from this formation contain a much higher per cent of clay substance.

Loess Clays.—Loess is used in a few places in the State in the manufacture of brick. Typical loess, especially that near the Mississippi River, is so finely comminuted and contains so much lime that bricks made from it are very easily broken. The loss of brick in some kilns ranges from one-third to nearly one-half. Where the material has been properly weathered a mixture of the loess and the overlying yellow loam makes a good, common brick. The weathered loess, which is found on the slopes of the bluffs, and that farther removed from the Mississippi River, is much better brick material than the unweathered loess.

A great improvement in the quality of the ware would result from the storing of the clay in covered sheds and allowing it to pass through a sweat before using. Storing the clay for a period of two months would greatly improve it. Still greater improvement would result from storing it for twelve months. The quality of the ware and the less amount of broken ware would pay the additional cost of handling the clay.

Columbia Clays.—Under the head of Columbia formation are included loams and clays which generally rest upon the surface of the Lafayette and the loess. "Brown loam" and "yellow loam" are terms which have also been applied to portions of the formation. The origin of the formation is in doubt, but it is very probably derived largely from the underlying formations. The Columbia clays are the principal sources of brick-material of southern Mississippi. They are used mainly in the manufacture of brick by the soft-mud process, though they are also used for stiff-mud and dry-pressed brick. The chemical composition of the Columbia clay may be seen in the following analysis, which is an average of four samples:

TABLE No. 4.

AVERAGE CHEMICAL COMPOSITION OF COLUMBIA CLAYS.

Moisture (H_2O)	3.02
Volatile matter (CO_2, etc.)	6.19
Silicon dioxide (SiO_2)	71.46
Aluminum oxide (Al_2O_3)	10.78
Iron oxide (Fe_2O_3)	5.49
Calcium oxide (CaO)	.86
Magnesium oxide (MgO)	.81
Sulphur trioxide (SO_3)	.53
Total	99.16

The amount of clay substance in the clay is 27.27 per cent. The clay contains 54.97 per cent of sand.

Recent Alluvial Clays.—The flood-plain areas of southern Mississippi contain alluvial clays which may be utilized successfully in the manufacture of brick. There are two general types of clays represented in these alluvial deposits. The first is a sandy clay which is generally deposited near the stream channels. The second is a more plastic type containing a higher percentage of clay and found in interstream areas. In the Yazoo basin the stiff clay is called "buckshot" clay. In color the first type is lighter than the second. In weight the reverse is true. An average chemical composition of two samples of these clays is given in the following table:

TABLE No. 5.

AVERAGE COMPOSITION OF ALLUVIAL CLAYS.

	Sandy Clay.	Buckshot Clay.
Moisture (H_2O)	2.68	6.26
Volatile matter (CO_2, etc.)	3.95	7.31
Silicon dioxide (SiO_2)	72.53	58.92
Aluminum oxide (Al_2O_3)	7.45	13.82
Iron oxide (Fe_2O_3)	6.04	8.74
Calcium oxide (CaO)	1.01	1.62
Magnesium oxide (MgO)	.69	.86
Sulphur trioxide (SO_3)	.39	1.74
Total	94.77	99.25

The amount of clay substance contained in the sandy clay is 18.84 per cent. In the second type it is 34.95 per cent. The amount of sand contained in the first type is 61.14 per cent; and in the second clay it is only 37.79 per cent. On account of the fineness of grain the "buckshot" clay presents difficulties in drying. The two clays may be more successfully utilized in making brick by mixing them.

BRICK CLAYS AND CLAY INDUSTRY OF SOUTHERN MISSISSIPPI BY COUNTIES.

ADAMS COUNTY.

GEOLOGY.

The bed-rock of Adams County consists of strata of Grand Gulf age. The Grand Gulf is composed of beds of clay, sand, sandstone and gravel. The surface of the bed-rock is concealed very largely by deposits of Lafayette, loess, Columbia and silt of the Mississippi.

The stratigraphy of the surficial formations may be studied best in the exposures along the bluffs of the Mississippi River. At Natchez, one mile north of the Yazoo and Mississippi Valley Railroad station, the following section is exposed in the river bank:

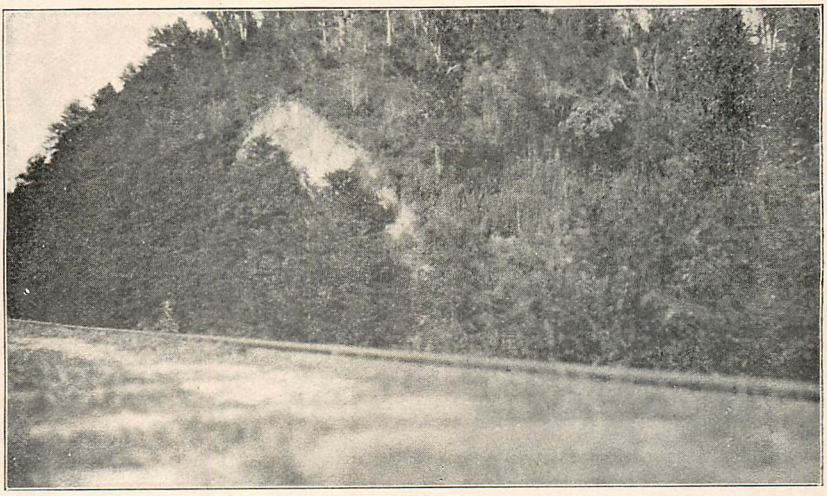
Section at Gravel Point North of Natchez.

		Feet.
5.	Loess, containing gastropod shells and lime concretions, capped in most places by a layer of brownish clay, grading into loam above, flour-like to the touch	40 to 50
4.	Reddish, sandy clay, coarse and gritty to the touch, apparently a residual product from a clayey sand	25 to 40
3.	Sands with gravel, tumultuously cross-bedded	100 to 150
2.	Coarse gravel and pebbles, yellow cherts predominate; some crystallines; many pebbles as large as 5 inches in one diameter, some cemented by limonite into pudding stone; layer exposed for 10 to 15 rods along river bank	8 to 10
1.	Greenish-gray clay, very plastic, exposed at water's edge; point of contact between this layer and the one above is about high-water mark or a little below	6 00

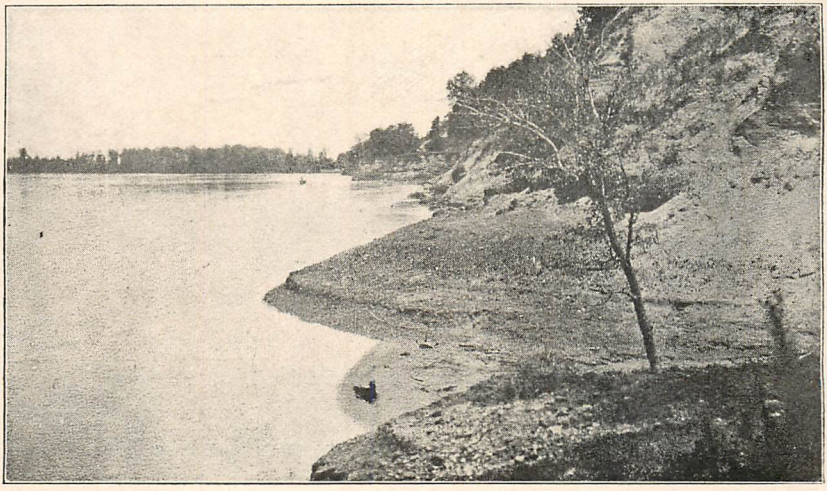
According to the views expressed by a majority of those who have made a study of the local stratigraphy at Natchez the following assignment would be the proper one for the various members of the above section: Stratum No. 1, belongs undoubtedly to the Grand Gulf, as that formation is now defined; No. 2 would be assigned to the Lafayette and No. 3 to the Natchez; No. 4 may be a residual deposit formed from the Natchez before the deposition of the loess (No. 5.)

Dr. T. C. Chamberlin, who made an examination of the geological conditions at Natchez, gave the name "Natchez" to a stratum of sands and gravels having a thickness of 200 feet. In speaking of the age of this formation Dr. Chamberlin says: (see Earth History, Volume III,

PLATE I.



A. LOESS BLUFF, NATCHEZ.



B. GRAND GULF? GRAVEL AND CONGLOMERATE, NATCHEZ.

page 386, under the head of "Natchez Formation.") "At Natchez, Mississippi, there is a section of assorted material about 200 feet in thickness, which is chiefly made up of derivatives from the Lafayette formation, upon which it rests unconformably, but also contains crystalline pebbles and calcareous clays assignable to wash from the glacial regions, all other assignments seeming to be excluded by a special examination. A marked interval between its deposition and that of the overlying loess is indicated. As the sub-Aftonian and Aftonian deposits are the only older ones with which great gravel deposits are known to be associated, and as the Natchez deposit must be referred to an early Pleistocene stage because the great Mississippi trench, sixty miles more or less, in breadth, has been excavated since it was formed, reference to one of these two stages is more plausible than to a later one. This reference is strengthened by the fact that almost the whole formation—which was clearly a valley train leading back to the drift area—has been removed. . . . . ."

In the bluff on the south side of the boat-landing at Natchez, much the same stratigraphical conditions as those recorded above are revealed.

Section South of Boat Landing, Natchez.

		Feet.
6.	Loess	40 to 50
5.	Reddish, sandy clay	20 to 30
4.	Green clay with white concretions, stratified	5 to 10
3.	White to yellow, cross-bedded sands with some small gravel in lower portion	70 to 100
2.	Coarse gravel and sand	20 to 30
1.	Hard thin sandstones with concretions	5 to 10

According to the above interpretation of this Section No. 6 is loess; No. 1 is Grand Gulf; No. 2 is Lafayette; and all between No. 2 and No. 6 is Natchez.

In a bayou, which cuts back into the western portion of Natchez from the river-front, the stratigraphy of the upper portion of the above section is repeated in a large number of exposures. The stratigraphy of one of these outcrops is given below:

Section in Bayou, Natchez.

		Feet.
4.	Loess containing gastropod shells	20 to 40
3.	Red to yellow, coarse sand or sandy clay	10 to 25
2.	Greenish-gray, stratified clay	5 to 10
1.	Fine sand, cross-bedded	50 to 60

Following the view expressed above Nos. 1 and 2 belong to the Natchez; Nos. 3 and 4 belong to the loess.

A question has been raised in the mind of the writer as to whether the sands and gravels referred to in the above sections as Lafayette and Natchez may not be referred properly to the Grand Gulf. In support of such an assignment the following facts may be cited:

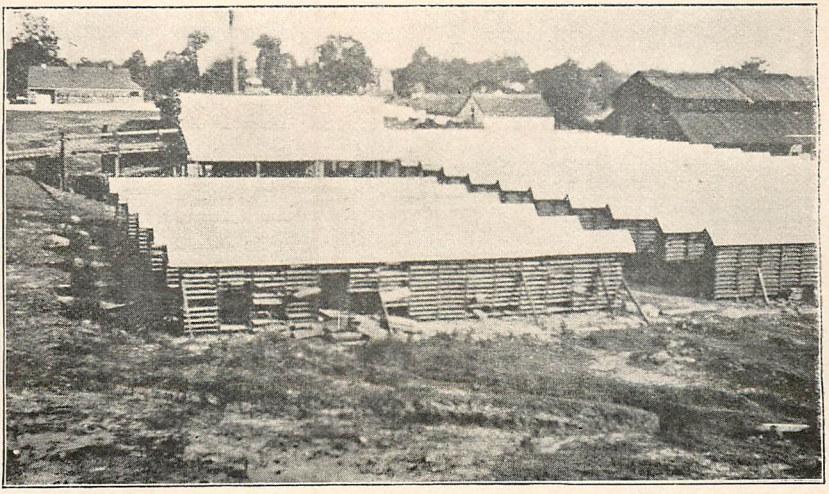
1. *The relation of these beds to those below the water-level at Natchez.* The grayish-green clays at the water level, just below the coarse gravel (Section at Gravel Point) have been assigned to the Grand Gulf by all who have made a study of the local conditions. According to the record of the water-work's well, the mouth of which is located about fifty feet above the level of the water in the river, there are beds of sand and gravel below this bed of Grand Gulf clay. The stratigraphical conditions above and below the clay bed are, therefore, similar and beds of sand and gravel are not foreign to the Grand Gulf at Natchez.

2. *The presence of stratified clays overlying the sands and gravels.* Capping the Grand Gulf rocks at Stonington, in Jefferson County, is a layer of clay which contains white lime concretions. A clay containing similar concretions is found overlying many exposures of these sands at Natchez. These clays are greenish in color and stratified. The Natchez is not present, and such clays are not found at other points in connection with the Lafayette. They must be either Grand Gulf or loess.

3. *The thickness of the formation excludes a Lafayette assignment.* The thickness of the sand and gravel beds at Natchez is between 200 and 300 feet. After a careful study of hundreds of outcrops of Lafayette in the State of Mississippi, I am of the opinion that beds of Lafayette exceeding fifty feet in thickness are extremely rare. A similar conclusion has been reached by other members of the present survey, each following independent lines of investigation. In Water Supply and Irrigation Paper No. 159, United States Geological Survey, Crider and Johnson, in speaking of the thickness of the Lafayette, say: "It varies from a knife-edge to fifty feet or more in thickness. The latter thickness is very rare, and it is more often found to be less than ten feet." Dr. Calvin S. Brown, in Bulletin No. 3, Mississippi State Geological Survey, The Lignite of Mississippi, says: "The name Lafayette, then, as used in this paper, will apply only to that layer of

Plate II.

A. PINNACLES OF SAND PROTECTED BY PEBBLES, NATCHEZ.



B. PLANT OF THE NATCHEZ BRICK MANUFACTURING COMPANY, NATCHEZ

sand, or sand and gravel, usually from five to fifteen feet thick, rarely exceeding forty or fifty feet thick, which in Quarternary times has been deposited unconformably upon the older formations following the hills and slopes according to the conformation reached about the close of the Tertiary period."

These facts are presented as an argument against the assignment of the whole of the sands and gravels of these beds to the Lafayette. Of course these facts have no bearing upon the assignment of the beds to the Natchez or to the Lafayette and Natchez.

4. *The presence of sands and gravels in the Grand Gulf at other points in the State.*—A log obtained from a well located at Columbia shows one hundred and sixty-eight feet of sands and gravels.. This bed is, doubtless, of Grand Gulf origin, since the greenish-gray clays of the Grand Gulf are found within a few feet of the surface near Columbia and form numerous outcrops at higher elevations along the bluffs of Pearl River. Sands and gravels also occur in Grand Gulf strata at Hattiesburg, Maxie, Bond, Howiston, Lumberton and other places.

5. *The stratigraphy of the Mississippi bluffs.*—At Yazoo City the Jackson clays and marls form the main body of the bluffs. These hills rise to a height of 300 to 400 feet above the flood-plain of the river. The Lafayette does not exceed twenty-five feet in thickness and contains a few gravels. The Natchez is not present. The loess lies upon the Lafayette and caps the tops of the hills.

At Vicksburg the main body of the bluffs is composed of the Vicksburg formation. The Lafayette, which overlies the Vicksburg, does not exceed twenty or twenty-five feet in thickness.. It contains a few water-worn pebbles and resembles, in a general way, stratum No. 4, in the Gravel Point section at Natchez. The Lafayette at Vicksburg is overlain by a thick bed of loess.

At Grand Gulf all the rocks of the bluffs, except the loess, are referred to the Grand Gulf formation by Hilgard. The rocks of the Grand Gulf at this point consist of sands, sandstones and clays.

At Ft. Adams, below Natchez, the main body of the bluffs is composed of sands and sandstones, which are considered to be of Grand Gulf age. The Grand Gulf formation is concealed by beds of Lafayette and loess.

The main body of the bluffs, both above and below Natchez, in so far as the observations of the writer are concerned, is composed of

strata older than the Lafayette. This being true, if we assume that the main body of the bluffs at Natchez is composed of strata younger than the Grand Gulf, we must assume exceptional conditions at that point. We must assume that a deep trench was cut in the Grand Gulf at right angles to the present trend of the river; that this trench was cut to the present water-level of the river; and that in this trench were deposited Lafayette sands and gravels, followed by the sands and gravels of the Natchez. Do such exceptional conditions exist or does the main body of the bluffs at Natchez, like the bluffs above and below, belong to the Grand Gulf?

CLAYS AND CLAY INDUSTRY.*

The loess and the Columbia, brown loam phase, which is, probably, largely a residual product of the loess, are being used in Adams County in the manufacture of brick. Other clay-bearing formations are the Lafayette, the Grand Gulf and the recent alluvium of the Mississippi flood-plain.

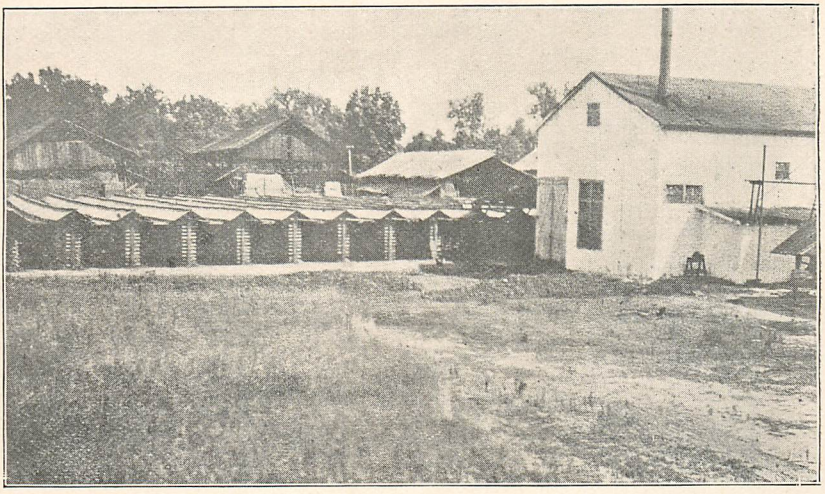
Natchez.—The Concord Brick Company of Natchez was organized in 1902. Three kinds of clay are used, a top loam, a middle, plastic clay and the non-plastic loess lying beneath. These are mixed together in the manufacture of brick by the soft-mud process. The bricks are molded in a steam-power machine. They are dried on pallets in open-air racks and are burned in up-draft kilns of the clamp type.

The plastic clay has a specific gravity of 1.97; has an air-shrinkage of 6 per cent, and requires 24 per cent of water to render it plastic. The clay slakes readily and speedily. The medium-burned briquets absorb from 8 to 12 per cent of water. The briquets lose about 5 per cent in weight in passing from an air-dried to a burned condition.

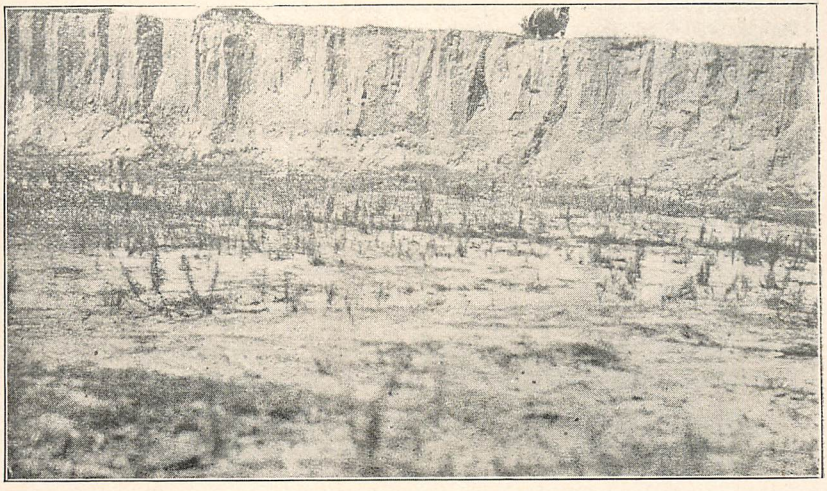
The Natchez Brick Manufacturing Company was established in 1897. The clay-pit exhibits about five feet of clay overlying the loess, but separated from it by about three feet of transitional material. One foot of the loess is mixed with the eight feet of overlying loam and clay in the manufacture of brick by the soft-mud process. The bricks are molded in a steam-power machine. The clay is first prepared in a dis-

*All briquets, the tests of which are recorded in the following pages, have been molded according to the method described on page 79 of Bulletin No. 2 of the Mississippi State Geological Survey. The burned briquets, the absorption tests of which are given, were all burned to a medium degree of hardness except as otherwise stated.

PLATE III.



A PLANT OF THE CONCORD BRICK MANUFACTURING COMPANY, NATCHEZ.



B. CLAY-PIT OF THE CONCORD BRICK MANUFACTURING COMPANY, NATCHEZ

integrator and pug mill. The bricks are placed on pallets and dried in sheds. They are then burned in clamp-kilns. The clay-pit is not far from the Concord Brick Company's pit, and the physical and chemical properties of the clays are very similar.

An analysis of a sample of gray loess is given below:

TABLE No. 6.

ANALYSIS OF LOESS, FROM NATCHEZ.

Insoluble matter	67.377
Peroxide of iron, Alumina	5.920
Potash	.139
Soda	.104
Lime	11.934
Magnesia	2.084
Brown oxide of manganese	.171
Phosphoric acid	.138
Sulphuric acid	.002
Carbonic acid	8.976
Organic matter and water	3.087
Total	99.932

The alluvial clay-deposits of Adams County have not been used as yet in the manufacture of brick. The flood-plain areas of the streams afford two types of clays, a sandy type, which occurs near the present streams, and a more plastic, inter-stream type. By a proper mixture of these two clays, brick and drain tile of good quality may be manufactured.

AMITE COUNTY.

GEOLOGY.

Amite County lies within the area underlain by the Grand Gulf formation. The bed-rock is largely concealed by the more surficial deposits of Lafayette and brown loam or Columbia. The gray clays of the Grand Gulf out-crop in deep cuts, and in other places where the sands and gravels of the Lafayette and the silty loams of the Columbia have been removed by erosion.

CLAYS AND CLAY INDUSTRY.

The clays of Amite County, suitable for the manufacture of brick, belong to the surface formations. Bricks have been manufactured at Liberty, Gloster and Peoria.

Liberty.—The Liberty Brick Manufacturing Company uses yellow, surface clay in the manufacture of brick by the soft-mud process.

The clay is tempered in a ring-pit. The bricks are molded by hand and dried in racks. In the clay-pit about five feet of yellow clay rests upon a bed of sand and gravel of Lafayette age. The clay from the yellow layer is sandy in the upper portion, but increases in clay-content toward the bottom.

Gloster.—In 1907 a few kilns of bricks were manufactured at Gloster. The clay used was yellow surface clay. It was tempered in a circular pug-mill and molded by hand. The bricks were burned in up-draft scove kilns.

Peoria.—A few kilns of bricks have been manufactured at or near Peoria. The clay used is a surface clay of Columbia age. The bricks were manufactured by the hand process.

CLAIBORNE COUNTY.

GEOLOGY.

Claiborne County contains the type locality of the Grand Gulf formation. The typical outcrop of the formation is at Grand Gulf, on the Mississippi River. As described by Dr. E. W. Hilgard (Geology and Agriculture of Mississippi, p. 148), the stratigraphy of the outcrop is as follows:

Section of the Bluff at Grand Gulf, Claiborne County.

		Feet.
12.	Calcerous silt of the Bluff formation, forming the hilltops	60 to 70
11.	Grand Gulf sandstone in ledges 10 inches to 2 feet in thickness; stratification often discordant and curved	14
10.	Gray sandy material, sometimes soft sandstone, with an argillaceous cement alternating with harder ledges 6 to 10 inches thick of friable, whitish sandstone	15
9.	Solid, whitish sandstone, of good quality	2½
8.	Greenish-gray clay with white veins of carbonate of lime	2½
7.	Soft white sandstone	1
6.	Grayish-yellow pipe clay	½
5.	Dark-gray, brittle sandstone	1
4.	Gray semi-indurate, clayey sand	3
3.	Gray and yellowish sands and clays, semi-indurate, interstratified	17
2.	Semi-indurate, gray sand	3
1.	Greenish-gray clay, with veins of carbonate of lime	2

The Grand Gulf is concealed in all places by deposits of Lafayette, loess and Columbia, except where erosion has removed the latter formations.

About one-half mile north of Martin, on the Yazoo and Mississippi Valley Railroad, the following section is exposed in a cut:

	Section Near Martin.	Feet.
4.	Brown loam	3
3.	Gravel and sandy loam	2
2.	Red, sandy clay	8
1.	White quartz rock	10

No. 1 is an almost pure, crystalline quartz-rock, belonging to the Grand Gulf formation. Nos. 2 and 3 are of Lafayette age, and No. 4 belongs to the Columbia.

In the southeastern part of this county, near Brandywine, are numerous outcrops of Grand Gulf clays, claystones and standstones. Some of the claystones weather, first, into parallelopipeds, then, by concoidal fracture, into lens-like bodies. In many places the surface deposits of Lafayette and Columbia loam are eroded into a "bad-land" type of topography. Some of the Grand Gulf claystones contain impressions of leaves. The chemical analyses of some of the clays, sandstones and claystones are found in the following table:

TABLE No. 7.

ANALYSES OF GRAND GULF CLAYS AND SANDSTONES.

	No. 3.	No. 4.	No. 7.	No. 8.
Moisture (H_2O)	3.59	1.09	00.74	2.36
Volatile matter (CO_2, etc.)	2.93	2.98	1.51	4.01
Silicon dioxide (SiO_2)	77.44	82.42	92.13	74.92
Aluminum oxide (Al_2O_3)	11.09	9.65	2.96	13.25
Iron oxide (Fe_2O_3)	4.17	2.40	1.61	2.96
Calcium oxide (CaO)	0.53	0.70	.54	.20
Magnesium oxide (MgO)	.31	.46	.42	.38
Sulphur trioxide (SO_3)	.05	.12	2.12	00.00
Total	100.11	99.62	99.96	100.20

No. 3 is a sandstone from near Brandywine; No. 4 is a very silicious clay from the same locality; No. 7 is a sandstone from near Clark, and No. 8 is a silicious clay from the same place.

CLAYS AND CLAY INDUSTRY.

The clay industry of Claiborne County has been developed only to a very limited extent. The clay-bearing formations are the Grand Gulf, the Lafayette and the Columbia.

Port Gibson.—The Port Gibson Brick and Tile Company was established in 1889. The old plant was burned and new machinery was installed in 1907. In the old plant the bricks were molded by the

stiff-mud process. They were dried in racks and burned in up-draft, clamp-kilns.

The clay slakes readily, is easily crushed and tempered. It is free from concretions and hard lumps which interfere with molding and cutting. The water required for plasticity is about 22 per cent. In air-drying the briquets shrink about 6 per cent. The burned briquets are red, and have an absorbtion of 8 to 10 per cent for medium hardness.

The thickness of the clay in the pit is eight feet with two feet or more of non-plastic, loess-like material underlying it. The clay is fairly uniform in quality throughout its entire thickness.

The flood-plain areas of Claiborne County contain clays which, with proper care in molding, drying and burning, will make good brick. The more plastic of these clays contain from 35 to 40 per cent of clay substance.

CLARKE COUNTY.

GEOLOGY.

The bed-rock formations of Clarke County include the Claiborne group, the Jackson formation and the Vicksburg formation. The northern part of the county is underlain by the Tallahatta buhrstone division of the Claiborne. The southern limit of this formation extends in a line through Enterprise to a point near where the 32° parallel crosses the State line. The Calcareous Claiborne, which borders the Tallahatta buhrstone on the south, forms the bed-rock of the central part of the county. The Jackson formation underlies the remainder of the county, with the exception of the southwestern corner, which is underlain by the Vicksburg formation. The surficial deposits of the county belong to the Lafayette and the Columbia. The Lafayette is represented by sands, clays and ironstones which attain their maximum thickness on the divides between the streams. The Columbia is usually very thin, thicknesses of over ten to fifteen feet are rare.

The Calcareous Claiborne consists of marls and clays. Below is given the composition of two samples of the Claiborne marl. The first sample is from Parker's Ferry, on Chickasawhay River, and the second sample is from Falling Creek.

TABLE No. 8.

ANALYSES OF CLAIBORNE MARLS, CLARKE COUNTY.

	No. 1.	No. 2.
Insoluble matter	66.347	65.540
Alumina	4.167	2.125
Lime	9.782	15.330
Potash	1.208	.375
Soda	.339	.246
Magnesia	1.442	.599
Brown oxide of manganese	.097	.076
Peroxide of iron	6.405	2.209
Phosphoric acid	.145	.086
Sulphuric acid	.397	.159
Carbonic acid	6.254	10.650
Organic matter and water	3.356	2.579
Total	99.939	99.974

The Jackson formation consists of clays, sands and marls. In many localities the clay contains crystals of selenite and the bones of the Zueglodon, an extinct whale-like animal. A sample of the gypsum-bearing clay from the Smith-farm at Barnett has the following composition:

TABLE No. 9.

ANALYSIS OF BARNETT CLAY.

	No. 83 (Old Series.)
Moisture (H_2O)	5.55
Volatile matter (CO_2)	13.80
Silicon dioxide (SiO_2)	38.75
Aluminum oxide (Al_2O_3)	22.83
Iron oxide (Fe_2O_3)	3.14
Calcium oxide (CaO)	14.25
Magnesium oxide (MgO)	1.01
Sulphur trioxide (SO_3)	Trace.
Total	99.33

The composition of three samples of marl from the Jackson formation of Clarke County is given below. No. 1 is from Smith's Spring; No. 2 is from Garland's Creek; and No. 3 is from Shubuta Ferry:

TABLE No. 10.

COMPOSITION OF JACKSON MARLS.

	No. 1.	No. 2.	No. 3.
Insoluble matter	72.783	45.881	52.289
Alumina	2.713	7.751	7.615
Lime	10.560	14.785	19.160
Potash	.639	1.117	.236
Soda	.096	.165	.100
Magnesia	.424	2.476	.355
Brown oxide of manganese	.094	.403	.368
Peroxide of iron	2.058	13.020	.....
Phosphoric acid	.468	.327	.353
Sulphuric acid	.297	.566	.583
Carbonic acid	7.967	12.492	15.428
Organic matter and water	2.173	00.00	3.611
Total	100.272	99.883	100.090

The Vicksburg limestone occurs in ledges of considerable thicknesses, and, although massive in structure, it may be cut into blocks

with ease. It is quarried and used in portions of Clarke County for chimneys and for foundations of houses. A sample of the Vicksburg limestone from the western part of Clarke County has the following composition:

TABLE No. 11.

ANALYSIS OF VICKSBURG LIMESTONE, CLARKE COUNTY.

Moisture (H_2O)	1.00
Volatile matter (CO_2)	35.20
Silicon dioxide (SiO_2)	7.31
Iron oxide (Fe_2O_3)	4.00
Aluminum oxide (Al_2O_3)	13.66
Calcium oxide (CaO)	35.20
Magnesium oxide (MgO)	.29
Sulphur trioxide (SO_3)	2 78
Total	100.86

CLAYS AND CLAY INDUSTRY.

The clays of the surface formations are the only ones in Clarke County which have as yet been employed in the manufacture of brick. The Lafayette clays are predominantly red, though thin beds of white clay are occasionally encountered. The red clays are generally stiff, with a jointed structure. The proportion of clay substance to the sandy matter is somewhat variable, but, as a rule, the quantity of the latter is not adequate for making soft-mud brick. Two varieties of Columbia loam are represented: A white to gray loam, which usually contains iron concretions, especially in the lower portion, and a brown loam. The former may represent the undrained areas of the Columbia.

Quitman.—At Quitman Mr. C. S. Edmonson uses a mixture of red Lafayette clay and Columbia loam in the manufacture of brick by the soft-mud process. The clay-pit exhibits the following stratigraphic details:

Section of Quitman Clay-Pit.

		Feet.
4.	Soil	1
3.	Brown loam, white in places	2 to 3
2.	Lafayette, red clay	7
1.	Sand, Lafayette	1

The thickness of the sand in No. 1 is not revealed in the clay-pit, but the record of the artesian well located at the brick-yard gives the thickness of the Lafayette sand at this point.

Record of Artesian Well, Quitman.

		Thickness Feet.	Depth Feet.
1.	Soil, Columbia loam and Lafayette clay	10	10
2.	Sand, Lafayette	20	30
3.	Marl, Calcareous Claiborne	140	170

The bricks manufactured at the Edmonson plant are molded in a soft-mud machine, which has a daily capacity of 15,000 bricks, and is operated by horse-power. The bricks are placed on pallets in covered racks and dried. They are burned in up-draught clamp-kilns, the water-smoking and burning requiring ten to twelve days for completion.

The chemical composition of the Columbia clays used at the Edmonson plant is found in the following table. No. 129 is the brown clay; No. 130 is the gray clay:

TABLE No. 12.

ANALYSES OF QUITMAN CLAYS.

	No. 129.	No. 130.
Moisture (H_2O)	1.64	1.50
Volatile matter (CO_2, etc.)	3.75	3.42
Silicon dioxide (SiO_2)	81.54	78.77
Aluminum oxide (Al_2O_3)	2.47	9.27
Iron oxide (Fe_2O_3)	4.15	3.00
Calcium oxide (CaO)	3.22	1.25
Magnesium oxide (MgO)	0.20	0.11
Sulphur trioxide (SO_3)	0.13	0.25
Total	97.10	97.57

RATIONAL ANALYSES.

Clay substance	6.25	23.45
Free silica	77.76	64.57
Fluxing impurities	7.70	4.61

The brown and the gray clay are mixed in the manufacture of brick and have about the same slaking speed. The amount of water required to render the mixture plastic adds 20 per cent to the weight of the clay. The amount of shrinkage which the clay undergoes in air-drying is 8 per cent. The average tensile strength per square inch of the brown clay briquets is 60 pounds.

COPIAH COUNTY.

GEOLOGY.

Copiah County lies within the area underlain by the Grand Gulf. The rocks of this group consist of clays, gravels, sands and sandstones. The mantle of Lafayette and Columbia, common to the Grand Gulf area, is present in this county also. The shallow wells which pierce this mantle, and usually obtain their water from its base, vary in depth from twenty to sixty feet. The stratigraphy of the mantle-rock is revealed in a railroad cut south of the brick-plant at Hazlehurst.

Lafayette-Columbia Section at Hazlehurst.

		Feet.
4.	Soil	1
3.	Brown-colored loam	4 to 5
2.	Brown sand, containing gravel	2 to 3
1.	Pink sand, containing gravel	10 to 15

Nos. 1 and 2 are Lafayette and No. 3 is Columbia.

CLAYS AND CLAY INDUSTRY.

Crystal Springs.—At Crystal Springs the Taylor-Thomas Brick Manufacturing Company uses the surface-loam clay (Columbia) in the manufacture of brick. The record of the well at the brick-plant shows the following local stratigraphy:

Record of Well at Taylor-Thomas Brick Plant, Crystal Springs.

		Thickness. Feet.	Depth. Feet.
1.	Clay	12	12
2.	Red sand and sandstone	30	42
3.	Red and white sand and gravel	30	72
4.	Clay	3	75
5.	Water-bearing sand and gravel	5	80

The clay from No. 1 is used in the manufacture of brick by the Taylor-Thomas Company. The clay is pulverized in a disintegrator and tempered in a pug-mill. It is then molded in a stiff-mud machine of the end-cut, auger-type. The bricks are burned in up-draft kilns, after being dried in sheds.

Hazlehurst.—The Hazlehurst Brick Company uses the brownish-yellow clay of the Columbia in the manufacture of brick. The clay-pit contains about six feet of clay, which rests upon the orange-colored sands of the Lafayette formation. These sands have a thickness of forty to fifty feet in the gulches and wells about Hazlehurst.

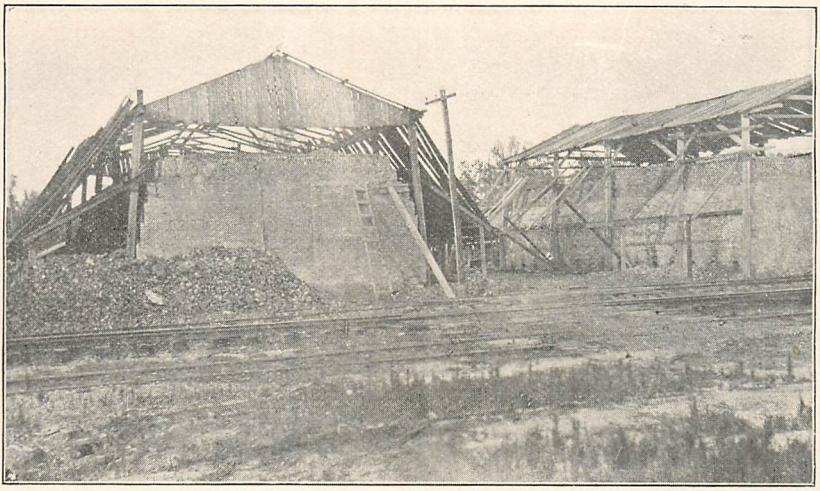
The clay used by this company is transported from the pit to the machine by the use of cable-cars, drum and hoist. The clay is then tempered in a pug-mill and molded in a stiff-mud, end-cut machine. The bricks are stacked in sheds to dry and are burned in clamp-kilns.

COVINGTON COUNTY.

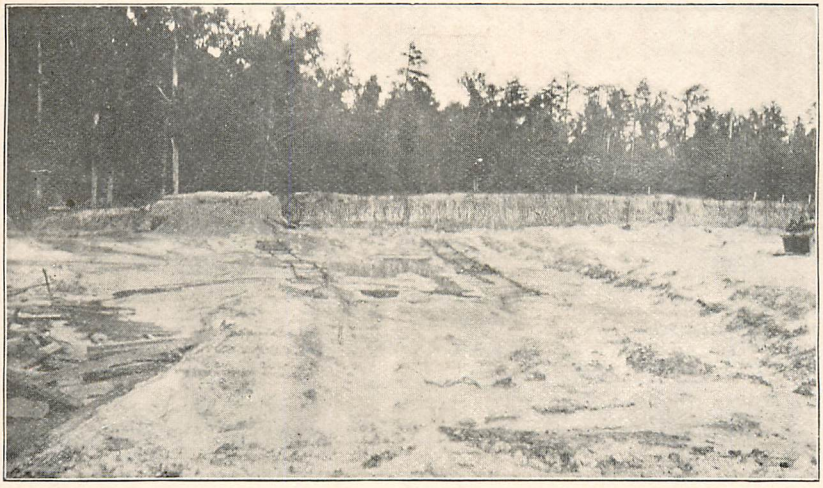
GEOLOGY.

The strata underlying the surface deposits of Covington County are of Grand Gulf age. The rocks of the Grand Gulf consist of clays, sandstones and gravels. The bed-rock is largely concealed by the orange-colored sands of the Lafayette and the yellowish loam of the Columbia.

PLATE IV.



A. KILNS OF THE MT. OLIVE BRICK MANUFACTURING COMPANY, MT. OLIVE.



B. CLAY-PIT OF THE MT. OLIVE BRICK MANUFACTURING COMPANY, MT. OLIVE.

CLAYS AND CLAY INDUSTRY.

The Lafayette and the Columbia formations contain suitable material for the manufacture of brick. The sandy clays of the Lafayette are suitable for the manufacture of soft-mud brick; the more plastic, Columbia clays, and the residual clay of the Grand Gulf may be used in other processes.

Mount Olive.—At Mount Olive a yellow clay and loam (Columbia) are used in the manufacture of brick by the Mount Olive Brick Manufacturing Company. The following section exhibits the different layers which occur in the clay-pit:

	Section of Clay Pit, Mt. Olive.	Feet.
4.	Soil, sandy	1
3.	Yellow clay (Columbia)	6 to 10
2.	Red sandstone (Lafayette)	1 to 2
1.	White, sandy clay (Grand Gulf)	3

The surface of No. 2 is very irregular there being a decided unconformity between this layer and the upper one. The clay from No. 3 is used in the manufacture of brick. The clay is transported from the pit to the plant by means of cars attached by cable to a drum and hoist. It is crushed in a disintegrator and tempered in a horizontal pug-mill, and is then molded in a stiff-mud machine of the auger-type. The bar of clay is separated into bricks by an end-cut table. Open sheds and a steam-dryer are used to dry the bricks. The bricks are burned in rectangular, up-draft kilns of the clamp-type.

The analysis of a sample of the unburned clay from Mount Olive is given in the following table:

TABLE No. 13.

ANALYSIS OF MT. OLIVE CLAY.

	No. 127.
Moisture (H_2O)	3.17
Volatile matter (CO_2, etc.)	5.81
Silicon dioxide (SiO_2)	71.25
Aluminum oxide (Al_2O_3)	11.17
Iron oxide (Fe_2O_3)	5.90
Calcium oxide (CaO)	0.47
Magnesium oxide (MgO)	0.38
Sulphur trioxide (SO_3)	1.98
Total	100.13

RATIONAL ANALYSIS.

Clay substance	28.26
Free silica	54.16
Fluxing impurities	8.73

FORREST COUNTY.

GEOLOGY.

The bed-rock formation of Forrest County is the Grand Gulf. The rocks of the formation are clays, sands and gravels. An idea of the character of the formation may be gathered from the record of an artesian well at Hattiesburg.

Log of an Artesian Well, Hattiesburg.

	Thickness. Feet.	Depth. Feet.
Pinkish clay	100	100
Water-bearing sand	30	130
Greenish clay	150	280
Water-bearing sand and gravel	20	300

In a deeper well the greenish clay occurred at a depth of 600 feet. Exposures of Grand Gulf are to be seen along the courses of Leaf River and its tributaries. The surficial formations of the county are of Lafayette and Columbia age.

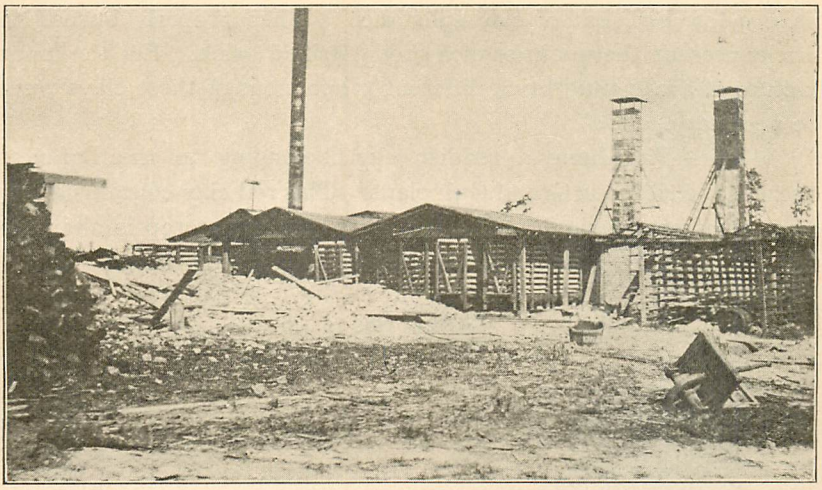
CLAYS AND CLAY INDUSTRY.

The Columbia clays are used in Forrest County in the manufacture of brick. These clays are not generally of very great thickness. In undrained or poorly drained areas they contain considerable "buck-shot" or iron concretions. In some places they rest directly upon the residual clays of the Grand Gulf, and in other places upon the sands and gravels of the Lafayette. The color of the clay is either gray or yellow and usually sandy in composition.

Hattiesburg.—At Hattiesburg bricks are manufactured by Mr. T. P. Crymes, who established his plant in 1902. The bricks are molded in a soft-mud, steam-power machine; dried in a steam dryer, and burned in up-draft, clamp-kilns. In the clay-pit a bed of yellow and gray clay, about three feet thick rests upon a plastic clay, which may be either Lafayette or Grand Gulf. The latter is too plastic to be used alone in the soft-mud process.

The Riverside Brick Company of Hattiesburg was established in 1901. The clay is prepared by crushing in a disintegrator and tempering in a pug-mill. The bricks are then molded in a soft-mud machine operated by steam-power. After being dried in sheds they are burned in clamp-kilns.

PLATE V.



PLANT OF THE CRYMES BRICK MANUFACTURING COMPANY, HATTIESBURG.

A gray clay mixed with a yellow loam and a sand are used in making brick. The composition of a sample of the yellow loam is given below:

TABLE No. 14.

ANALYSIS OF HATTIESBURG YELLOW LOAM.	No. 123.
Moisture (H_2O)	1.27
Volatile matter (CO_2, etc.)	2.82
Silicon dioxide (SiO_2)	85.49
Aluminum oxide (Al_2O_3)	1.65
Iron oxide (Fe_2O_3)	2.52
Calcium oxide (CaO)	0.67
Magnesium oxide (MgO)	0.18
Sulphur trioxide (SO_3)	0.10
Total	94.70
RATIONAL ANALYSIS.	
Clay substance	4.17
Free silica	82.97
Fluxing impurities	3.47

The following is an analysis of the gray clay:

TABLE No. 15.

ANALYSIS OF HATTIESBURG GRAY CLAY.	No. 128.
Moisture (H_2O)	1.34
Volatile matter (CO_2, etc.)	2.84
Silicon dioxide (SiO_2)	87.45
Aluminum oxide (Al_2O_3)	1.87
Iron oxide (Fe_2O_3)	2.57
Calcium oxide (CaO)	2.50
Magnesium oxide (MgO)	0.13
Sulphur trioxide (SO_3)	0.37
Total	99.07
RATIONAL ANALYSIS.	
Clay substance	4.73
Free silica	84.59
Fluxing impurities	5.57

It will be seen from the above analyses that these two materials have a low per cent of clay substance. When properly burned the bricks present the qualities of a good vitrified brick. For the manufacture of a stiff-mud brick different proportions of these clays would be necessary.

Maxie.—At Maxie a reddish clay belonging to the Lafayette overlies the siliceous Grand Gulf clays. This red clay contains a large amount of coarse sand. The thickness of the outcrop is about ten feet. A sample of the clay has the following composition:

TABLE No. 16.

ANALYSIS OF MAXIE CLAY.

	No. 135.
Moisture (H_2O)	2.23
Volatile matter (CO_2, etc.)	3.90
Silicon dioxide (SiO_2)	79.85
Aluminum oxide (Al_2O_3)	2.60
Iron oxide (Fe_2O_3)	3.75
Calcium oxide (CaO)	1.00
Magnesium oxide (MgO)	0.15
Sulphur trioxide (SO_3)	0.19
Total	93.67

RATIONAL ANALYSIS.

Clay substance	6.58
Free silica	75.88
Fluxing impurities	5.09

This clay is not sufficiently plastic to be used alone in the manufacture of stiff-mud brick. However, it could be employed with success in the manufacture of soft-mud brick. In some places a residual clay, which occurs at the base of the Lafayette, may be used in the manufacture of brick. However, care must be exercised in drying such clays in order to prevent cracking.

FRANKLIN COUNTY.

GEOLOGY.

Franklin County is underlain by Grand Gulf strata consisting of sandstones, clays and sands. The surface deposits are of Lafayette and Columbia age. The white sandstones of the Grand Gulf in Franklin County out-crop in a ridge along the principal divide, which forms what is termed the "Devil's Backbone." Below is given the composition of a sample of gray, Grand Gulf clay from Cassidy's Bluff, on Homochitto River:

TABLE No. 17.

ANALYSIS OF GRAND GULF CLAY, CASSIDY'S BLUFF.

Insoluble matter	49.475
Alumina	12.587
Lime	13.190
Potash	1.242
Soda	.152
Magnesia	1.829
Brown oxide of manganese	.266
Peroxide of iron	5.538
Phosphoric acid	.132
Sulphuric acid	.033
Carbonic acid	9.555
Organic matter and water	5.876
Ttoal	99.875

CLAYS AND CLAY INDUSTRY.

The clay industry in this county has been only slightly developed. Surface clays, from which a good grade of brick may be manufactured, are abundant, and for that reason, the future of the industry is bright. The best clays for brick are the surface, residual loess and the Columbia loam.

Meadville.—The Meadville Brick Manufacturing Company was established in 1907. The bricks are manufactured by the stiff-mud process. The clay used is a surface clay of Columbia age.

The analysis of the Grand Gulf clay from Cassidy's Bluff, referred to under the head of Geology, exhibits nearly 32 per cent of clay substance. It has the proper plasticity for a good, stiff-mud or dry-pressed brick. The per cent of lime which it contains would be detrimental unless uniformly distributed in the clay. On account of the fineness of grain of the sand contained in the clay, the ware must be dried with great care in order to prevent cracking.

GREENE COUNTY.

GEOLOGY.

Greene County is one of the counties which lies within the area of the Grand Gulf outcrop. The formation consists for the most part of sands and of greenish-gray clays. In the Leakesville well 350 feet of these clays were penterated. The record of the well is given below:

Record of the Leakesville Public Well.

		Thickness. Feet.	Depth. Feet.
1.	Sandy, yellow clay	6	6
2.	Bluish, pipe clay	10	16
3.	Water-bearing sand	24	40
4.	Greenish-gray clay	350	390
5.	Water-bearing sand	10	400
6.	Bluish clay	50	450
7.	Water-bearing sand	30	480

The Grand Gulf clays are exposed in the banks of Chickasawhay River at Leakesville. They overlie a stratum of white sand. The water flowing over the surface of the clays leaves a yellow, iron, rust-like incrustation or coloration. This iron-deposit is, doubtless, produced by the oxidation of the iron pyrites contained in the clay.

The bed-rock of Greene County is largely concealed by beds of Lafayette and Columbia. A range of high hills in the southeastern part of the county is capped by Lafayette sands and clays. Numerous springs are found along the line of contact between the sands and the underlying clays.

CLAYS AND CLAY INDUSTRY.

The clays of Greene County belong to the Grand Gulf, the Lafayette and the Columbia formations. The clays of the Lafayette are generally red in the upper part and mottled near the base of the formation. At many points the Columbia loam rests directly upon the surface of this clay, no sand or gravel being present. The clays from the Lafayette and the Columbia are used in Greene County in the manufacture of brick.

Leakesville.—The Leakesville Brick Manufacturing Company was organized in 1906. The bricks are molded in a stiff-mud machine of the vertical type. They are dried in open sheds and burned in scove kilns. The clay-pit exhibits three kinds of clay, as shown in the following section.

Section of Clay-Pit, Leakesville.

		Feet.
4.	Sandy soil	1
3.	Sandy loam, yellow	3
2.	Gray and red-mottled, plastic clay	3
1.	Greenish-gray clay	4

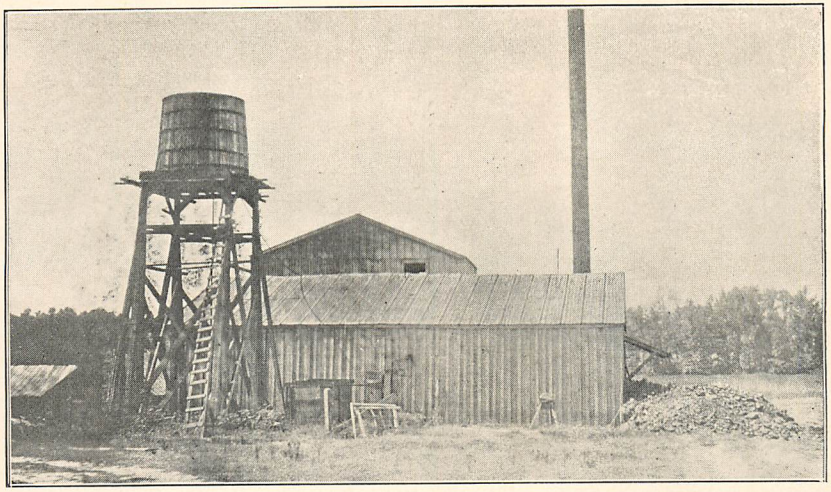
In the analyses given below No. 122 is a sample taken from layer No 1; No. 124 is a sample of the mixture of layers Nos. 2 and 3, used in the manufacture of brick.

TABLE No. 18.

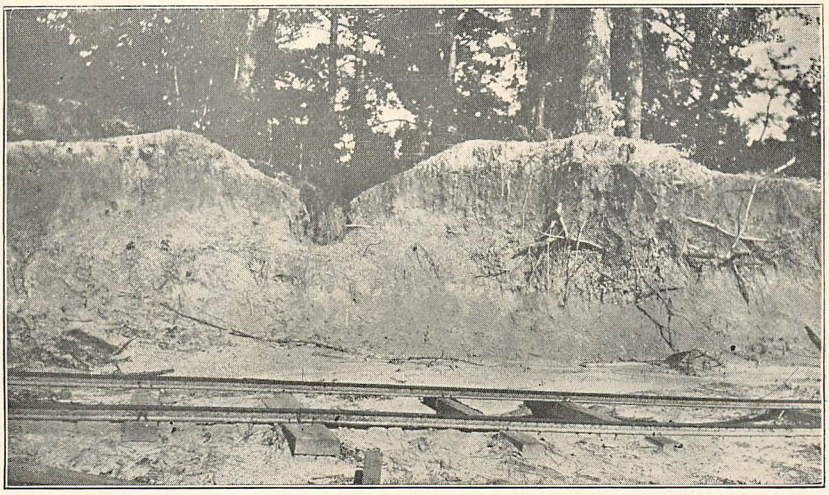
ANALYSES OF LEAKESVILLE CLAYS.

	No. 122.	No. 124.
Moisture (H_2O)	2.86	1.54
Volatile matter (CO_2, etc.)	3.94	2.95
Silicon dioxide (SiO_2)	62.31	84.76
Aluminum oxide (Al_2O_3)	5.52	2.62
Iron oxide (Fe_2O_3)	17.48	6.98
Calcium oxide (CaO)	7.50	0.57
Magnesium oxide (MgO)	0.41	0.02
Sulphur trioxide (SO_3)	0.34	0.25
Total	100.36	99.69

PLATE VI



A. POWER-PLANT OF THE SUMMIT BRICK MANUFACTURING COMPANY, SUMMIT.



B. CLAY-PIT OF THE LEAKESVILLE BRICK MANUFACTURING COMPANY, LEAKESVILLE

TABLE No. 18—Continued.

RATIONAL ANALYSES.

Clay substance	13.96	6.62
Free silica	53.87	80.76
Fluxing impurities	25.73	7.82

The yellow, sandy loam slakes readily, but does not contain much clay substance. The mottled clay does not contain as much sand as the yellow clay and the particles adhere more firmly. The gray clay, at the bottom, contains the highest per cent of clay substance. It also contains a high per cent of fluxing impurities, especially iron. The iron in the form of an oxide originates from the decomposition of iron pyrites contained in the clay.

When properly treated the clays from layers 2 and 3 will make a fair quality of brick.

HANCOCK COUNTY.

GEOLOGY.

The rocks of the Grand Gulf and the Port Hudson underlie the mantle-rock of this county. The mantle-rock consists of beds of Lafayette sands and loams, of Columbia age, as well as residual clays and sands from the older formations.

CLAYS AND CLAY INDUSTRY.

The clay industry of Hancock County has been but little developed. A surface clay is being used in the manufacture of brick at only one point.

Bay St. Louis.—In 1902 Mr. W. T. Moon located a brick plant about three miles north of Bay St. Louis. The clay used is a mottled sandy clay from a surface deposit. The stratigraphy of the clay-pit is given below.

	Section of the Moon Clay-Pit, Bay St. Louis.	Feet.
4.	Soil, sandy	1
3.	Sandy loam	3
2.	Red and blue sandy clay	3
1.	Sand	1

Layers 2 and 3 are used in the manufacture of brick. The bricks are molded in a steam-power, soft-mud machine and burned in up-draft kilns, after being dried in sheds.

The sandy loam slakes readily and does not contain a high per cent of clay substance. Layer No. 2 is a more plastic clay, which does not

slake as readily as the sandy loam. The amount of fluxing impurities is not excessive, but the clay contains enough iron to give a red color to the burned product.

HARRISON COUNTY.

GEOLOGY.

The principal bed-rock formation of Harrison County is the Grand Gulf. The sub-surface of the coastal area is composed of white sands and greenish marls which are younger than the Grand Gulf. These sediments were referred to the Port Hudson epoch by Dr. Hilgard. The white sands were named the Biloxi sands by Mr. L. C. Johnson. The term Ponchartrain has been applied to a group of coastal clays typically developed near Lake Ponchartrain and represented in Harrison County. The mantle-rock in the northern part of the county consists of beds of sands and gravels, and the residual clays and sands of the Grand Gulf.

CLAYS AND CLAY INDUSTRY.

The clays of Harrison County, which are being used in the manufacture of brick, are surface clays, probably of Columbia age.

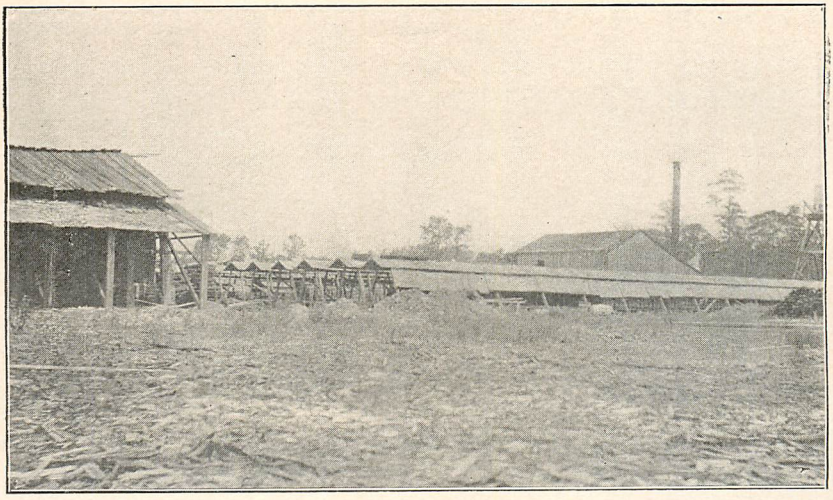
Landon.—The Landon Brick and Tile Company was established in 1902. The clay is brought from the pit in cars by the aid of drum and hoist. It is tempered in a pug-mill and molded in a stiff-mud machine of the horizontal type. A side-cutting table is used. The bricks are stacked in sheds for drying, and burned in up-draft, clamp-kilns. The clay-pit contains the following layers:

Section of Landon Clay-Pit.

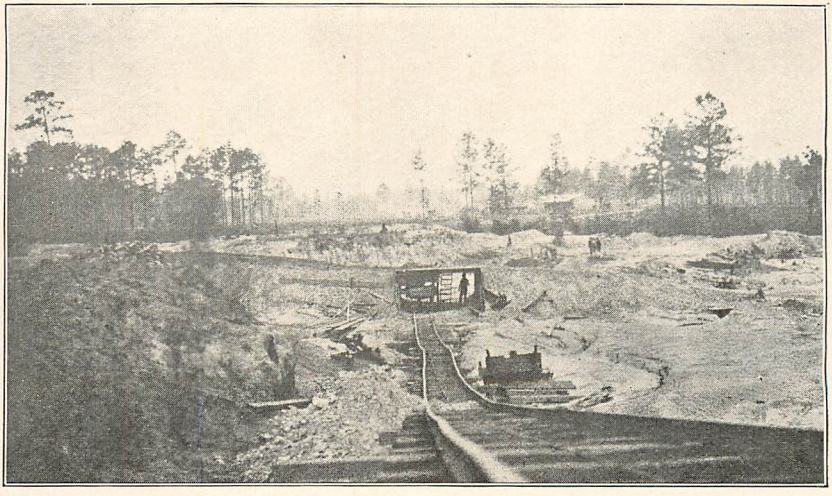
		Feet.
3.	Yellowish loam and sand	5
2.	Bluish or mottled clay	4
1.	Dark clay with shells	6

Clay No. 2 is mixed with a portion of sandy clay from No. 3 in the manufacture of brick. A mixture of one-third sand to two-thirds clay seems to give the best results. The sand decreases the shrinkage and insures more successful results in drying and burning. The composition of this mixture is given in No. 125, in the table below; No. 126 is from layer No. 2:

PLATE VII.



A. PLANT OF THE LANDON BRICK AND TILE COMPANY, LANDON.



B. CLAY-PIT OF THE LANDON BRICK AND TILE COMPANY, LANDON.

TABLE No. 19.

ANALYSES OF LANDON BRICK CLAYS.

	No. 125.	No. 126.
Moisture (H_2O)	2.28	2.01
Volatile matter (CO_2, etc.)	4.17	4.84
Silicon dioxide (SiO_2)	78.00	77.52
Aluminum oxide (Al_2O_3)	7.72	10.87
Iron oxide (Fe_2O_3)	5.05	3.80
Calcium oxide (CaO)	1.40	0.60
Magnesium oxide (MgO)	0.16	0.43
Sulphur trioxide (SO_3)	0.30	0.08
Total	99.08	100.15

RATIONAL ANALYSES.

Clay substance	19.53	27.50
Free silica	66.19	60.79
Fluxing impurities	6.91	4.91

The amount of sand-dilution reduces the clay-content from 27.50 per cent in the untempered clay to 19.53 per cent in the mixture. The amount of free silica is increased by 5.40 per cent. There is also an increase in the amount of fluxing impurities from 4.91 per cent in the untempered clay to 6.91 per cent in the mixture.

Biloxi.—The Imperial Brick Company of Biloxi, established a plant on Back Bay in 1906 for the manufacture of brick. The clay is prepared by a granulator and disintegrator and tempered in a horizontal pug-mill. The bricks are molded in a stiff-mud end-cut machine. They are dried in sheds and burned in rectangular, up-draft kilns. The clay-pit contains the following layers:

Clay-Pit of the Imperial Brick Company, Biloxi.	Feet.
3. Yellow clay	3
2. Sand and gravel	3
1. Greenish-colored clay	4

TABLE No. 20.

ANALYSES OF IMPERIAL BRICK COMPANY'S CLAYS, BILOXI.

	No. 133.	No. 134.
Moisture (H_2O)	2.52	6.71
Volatile matter (CO_2, etc.)	3.30	8.08
Silicon dioxide (SiO_2)	82.00	55.73
Aluminum oxide (Al_2O_3)	7.67	17.90
Iron oxide (Fe_2O_3)	3.00	8.50
Calcium oxide (CaO)	0.50	0.25
Magnesium oxide (MgO)	0.09	0.54
Sulphur trioxide (SO_3)	0.17	1.38
Total	99.25	99.09

RATIONAL ANALYSES.

Clay substance	19.40	45.29
Free silica	70.27	28.34
Fluxing impurities	3.76	8.67

No. 133 is from layer No. 3; No. 134 is from layer No. 1.

The air-shrinkage of the surface clay is 9 per cent; its total shrinkage is 10 per cent. The amount of water required to render it plastic is 21 per cent. The raw clay has a tensile strength of 210 pounds; the burned briquets have a tensile strength of 315 pounds. When mixed with 10 per cent of coal the clay required 22 per cent of water to render it plastic; has an air-shrinkage of 8 per cent; a total shrinkage of 10 per cent; tensile strength, raw, 140 pounds, and burned 278 pounds. The clay mixed with 10 per cent of coal cinders requires 23 per cent of water to render it plastic; has an air-shrinkage of 8 per cent; a total shrinkage of 9 per cent; has a tensile strength, raw, of 230 pounds, and a tensile strength, burned, of 350 pounds.

The analyses of two samples of clay collected by Mr. A. F. Crider from outcrops at Biloxi are given in the following table:

TABLE No. 21.

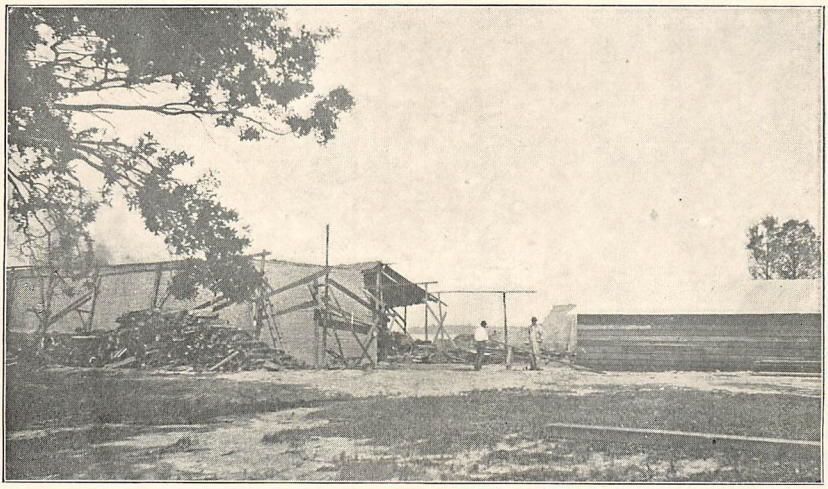
ANALYSES OF BRICK CLAYS FROM BILOXI.

	No. 116.	No. 120.
Moisture (H_2O)	6.31	6.76
Volatile matter (CO_2, etc.)	5.20	6.49
Silicon dioxide (SiO_2)	68.80	58.80
Aluminum oxide (Al_2O_3)	12.55	14.52
Iron oxide (Fe_2O_3)	5.00	6.25
Calcium oxide (CaO)	1.92	0.92
Magnesium oxide (MgO)	0.27	0.60
Sulphur trioxide (SO_3)	0.08	0.91
Total	100.13	95.25
RATIONAL ANALYSES.		
Clay substance	31.75	36.73
Free silica	49.60	36.59
Fluxing impurities	7.27	8.68

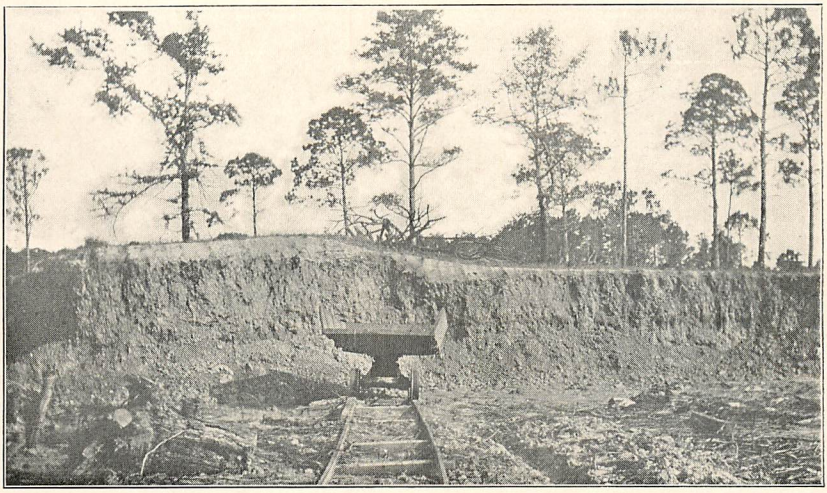
No. 116 is from the Watkins place and No. 120 is from the clay-pit of the Imperial Brick Company. These two clays contain a high percentage of clay substance, and, owing to their physical condition they are suitable for the manufacture of brick. They will each bear considerable sand-dilution. However, they appear to possess moderately weak bonding power, so that if the clay receives much dilution it will be necessary to burn the ware to the point of viscosity in order to insure the necessary strength. It is quite probable that saw dust mixed with the clay would give better results than sand, as sand reduces the bonding power.

Saucier.—At Saucier there in a stiff clay varying in color from red to blue and having the following composition:

PLATE VIII.



A. KILNS OF THE IMPERIAL BRICK COMPANY, BILOXI.



B CLAY-PIT OF THE IMPERIAL BRICK COMPANY, BILOXI.

TABLE No. 22.

ANALYSIS OF SAUCIER CLAY.

	No. 119.
Moisture (H_2O)	4.60
Volatile matter (CO_2, etc.)	6.72
Silicon dioxide (SiO_2)	62.30
Aluminum oxide (Al_2O_3)	10.53
Iron oxide (Fe_2O_3)	10.35
Calcium oxide (CaO)	1.50
Magnesium oxide (MgO)	0.45
Sulphur trioxide (SO_3)	0.20
Total	96.65

RATIONAL ANALYSIS.

Clay substance	26.64
Free silica	46.19
Fluxing impurities	12.50

This clay requires 25 per cent of water to render it plastic; has an air-shrinkage of 13 per cent; a total shrinkage of 15 per cent. In the raw state it has a tensile strength of 286 pounds; and a strength of 572 pounds, when burned. In table No. 23 the results of the dilution of Saucier clay, with various proportions of non-plastic substances, are given:

TABLE No. 23.

SAUCIER CLAY DILUTION.

Mixture.	Water required.	Shrinkage. Air.	Total.	Tensile Strength. Raw, lbs.	Burned, lbs.
Clay and ⅛ sand	22.13%	7%	10%	170	154
Clay and ¼ sand	20.96%	6%	10%	183	134
Clay and ⅜ sand	24.16%	8%	10%	195	123
Clay and 10% cinders	23.93%	9%	11%	184	240
Clay and 10% coal	25.89%	9%	12%	173	163

The amount of clay substance in this clay is about that of the Landon clay, which requires a sand dilution of one-third. On account of the physical nature of the clay, dilution of some kind is necessary in order to facilitate drying. Judging from the above results the cinder-dilution is the best.

Ten-Mile.—At Ten-Mile in Harrison County, there is an outcrop of grayish-green clays belonging to the Grand Gulf. These clays weather to a yellow or brownish-red. A sample of the clay has the following composition:

TABLE No. 24.

ANALYSIS OF TEN-MILE CLAY.

	No. 136.
Moisture (H_2O)	5.32
Volatile matter (CO_2, etc.)	7.31
Silicon dioxide (SiO_2)	64.07
Aluminum oxide (Al_2O_3)	14.40
Iron oxide (Fe_2O_3)	6.27
Calcium oxide (CaO)	0.03
Magnesium oxide (MgO)	1.09
Sulphur trioxide (SO_3)	1.86
Total	100.35

TABLE No. 24—Continued.

RATIONAL ANALYSIS.

Clay substance	36.43
Free silica	42.04
Fluxing impurities	9.25

The per cent of clay substance in this clay is high as compared with the Landon mixture. Some form of dilution is essential to the successful working of this clay. The free-silica content is of very fine grain. The clay thus retains its moisture very tenaciously and some form of dilution is necessary to insure rapid and successful drying. Sandy loams are found in the surface deposits which may be utilized for this purpose.

Tchouticabouff River.—A sample of clay collected from Tchouticabouff River by Mr. A. F. Crider, has the following chemical properties:

TABLE No. 25.

ANALYSIS OF CLAY FROM TCHOUTICABOUFF RIVER.

	No. 118.
Moisture (H_2O)	1.46
Volatile matter (CO_2, etc.)	7.91
Silicon dioxide (SiO_2)	80.16
Aluminum oxide (Al_2O_3)	2.60
Iron oxide (Fe_2O_3)	1.35
Calcium oxide (CaO)	0.75
Magnesium Oxide (MgO)	0.45
Sulphur trioxide (SO_3)	1.11
Total	95.79

RATIONAL ANALYSIS.

Clay substance	6.57
Free silica	76.98
Fluxing impurities	3.66

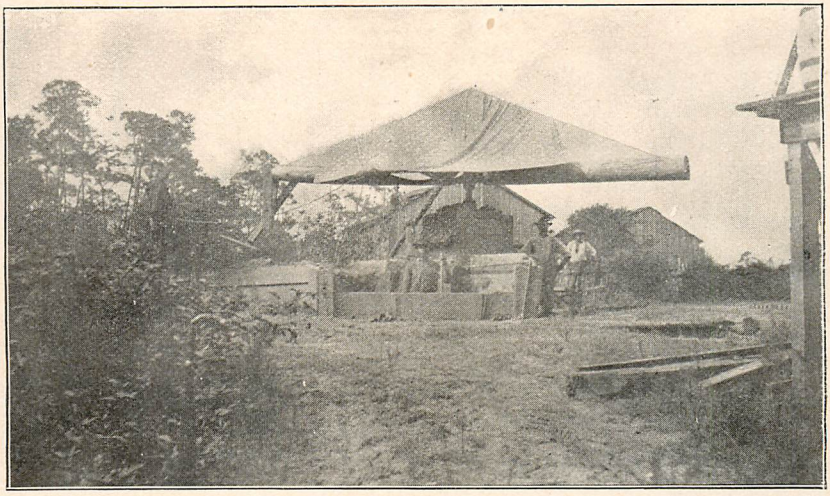
The clay is dark, due, doubtless, to the presence of organic matter. It burns white. It contains only a small per cent of clay substance, and, therefore, lacks bonding power. The clay requires the addition of 20 per cent of water to render it plastic; has an air-shrinkage of 6 per cent, and a total shrinkage of 6 per cent; the tensile strength of the raw clay is 85 pounds; the tensile strength of the burned clay is 45 pounds.

JACKSON COUNTY.

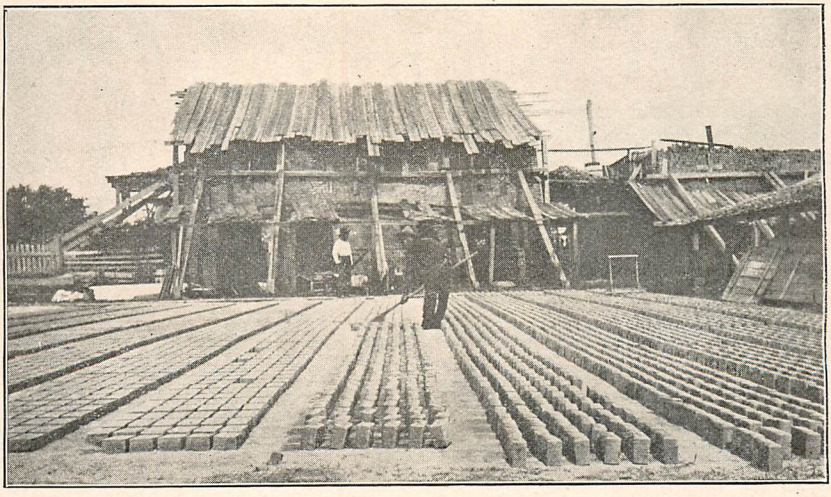
GEOLOGY.

Jackson is one of the counties of Mississippi bordering on the Gulf. The surface formations of the county are underlain by rocks belonging to the Grand Gulf and to the Port Hudson formations. The mantle rock consists of Lafayette sands and clays, Columbia loam and the

PLATE IX



A. SOFT-MUD, HORSE-POWER BRICK-MACHINE, MOSS POINT.



B. EDGING BRICK ON OPEN YARD, MOSS POINT.

residual material from the bed-rock formations. Alluvial clays, sands and loams have been deposited along the flood-plain of Pascagoula River, which constitutes the principal line of drainage for Jackson County.

CLAYS AND CLAY INDUSTRY.

The clays of Jackson County, which are being utilized in the manufacture of brick, belong to a surface deposit, probably of Columbia age. The clays are, as a general rule, yellow or blue and of a sandy nature.

Moss Point.—At Moss Point Mr. A. Blumer manufactures building brick by the soft-mud process. The bricks are molded in a soft-mud machine which is operated by horse-power. They are dried in open yards and sheds, and are burned in rectangular, up-draft kilns. The clay-pit contains a yellow sand or sandy clay overlying about three feet or more of yellow and blue clay. The two are mixed in order to produce the brick.

Orange Grove.—In 1906 The Orange Grove Brick and Tile Company erected a plant for the manufacture of brick by the dry-press method. The clay-pit contains a layer of gray or yellow clay resting upon a bed of sandy blue and yellow clay. The chemical composition of the yellow clay is shown in the following analysis:

TABLE No. 26.

ANALYSIS OF ORANGE GROVE CLAY.

	No. 121.
Moisture (H_2O)	3.15
Volatile matter (CO_2, etc.)	5.12
Silicon dioxide (SiO_2)	72.23
Aluminum oxide (Al_2O_3)	12.63
Iron oxide (Fe_2O_3)	5.87
Calcium oxide (CaO)	0.50
Magnesium oxide (MgO)	0.09
Sulphur trioxide (SO_3)	0.17
Total	99.76

RATIONAL ANALYSIS.

Clay substance	31.95
Free silica	52.91
Fluxing impurities	6.65

The per cent of clay substance is highest in the bottom layer. It is evident that one-half of the clay consists of sand. In crushing the clay there is a tendency for the more plastic portions to form pellets. These pellets are not always destroyed in molding. In order for the brick to have the proper tensile strength it is necessary, in burning, to raise the temperature of the clay to viscosity, at which point reunion of the particles takes place.

Ocean Springs.—A sample of clay collected by Mr. A. F. Crider from an out-crop at Ocean Springs, has the following composition:

TABLE No. 27.

ANALYSIS OF OCEAN SPRINGS CLAY.

	No. 117.
Moisture (H_2O)	5.16
Volatile matter (CO_2, etc.)	6.94
Silicon dioxide (SiO_2)	61.27
Aluminum oxide (Al_2O_3)	17.97
Iron oxide (Fe_2O_3)	3.88
Calcium oxide (CaO)	1.10
Magnesium oxide (MgO)	0.32
Sulphur trioxide (SO_3)	0.89
Total	97.53

RATIONAL ANALYSIS.

Clay substance	45.46
Free silica	38.77
Fluxing impurities	6.25

The clay contains a high per cent of clay substance, and, since the sand contained is in a finely divided state, considerable difficulty is experienced in drying it successfully. Further sand-dilution would result in a loss of bonding power. This loss could be met only by hard burning. The clay slakes slowly and requires 22 per cent of water to render it plastic. The tensile strength of the raw clay is 200 pounds per square inch. The burned briquets have a tensile strength of 450 pounds per square inch. Some of the clays cracked very badly at the point of incipient fusion.

JASPER COUNTY.

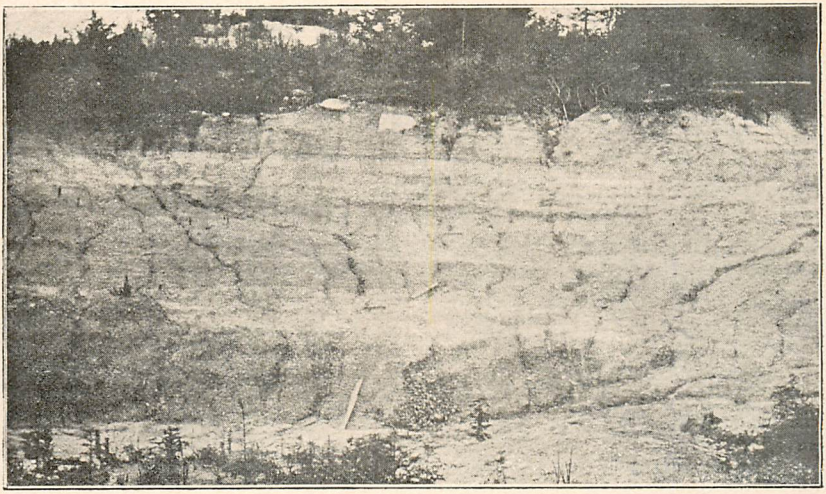
GEOLOGY.

The northeastern portion of Jasper County is underlain by the Calcareous Claiborne, consisting of marls and sands. The north-central portion of the county is underlain by Jackson clays, marls and sands. The south-central portion is underlain by the Vicksburg limestone, and the southwestern portion by the Grand Gulf clays. These bed-rock formations are mantled by deposits of sand, clays and loam belonging to the Lafayette and the Columbia.

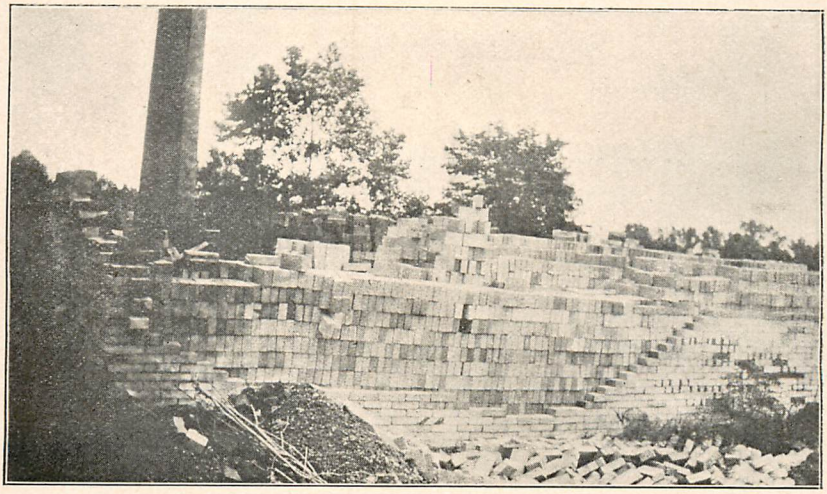
CLAYS AND CLAY INDUSTRY.

The clay industry has had very little development in Jasper County. Clays suitable for the manufacture of brick are to be found in the Lafayette and the Columbia formations, and the residual

PLATE X.



A. GRAND GULF WHITE CLAY, STONINGTON.



B. PRESSED BRICK MADE FROM GRAND GULF CLAY, STONINGTON.

clays of the older formations, particularly the Jackson and the Grand Gulf. These residual clays will, in most instances, require mixing with sand in order to insure successful drying.

JEFFERSON COUNTY.

GEOLOGY.

The bed-rock formations of Jefferson County belong to the Grand Gulf. The Grand Gulf rocks comprise sands, silicious clays, gravels and sandstones. The overlying beds of mantle-rock consist of sands and gravels of the Lafayette and the loams of the Columbia.

The stratigraphy of the mantle-rock and its relation to the underlying bed-rock, is revealed in the following section taken from a railroad cut at Fayette.

Section at Fayette.

		Feet.
4.	Brownish, yellow loam	6
3.	Gravel and loam	3
2.	Purple to red or green sticky clays	6
1.	Gray clay with thin layers of sandstone	5

Nos. 1 and 2 are of Grand Gulf age; No. 3 is Lafayette; and No. 4 Columbia. In a small draw west of the railroad station at Fayette another section is exposed as follows:

Section West of Station, Fayette.

		Feet.
4.	Brown loam	4
3.	Sandy clay and gravel	6
2.	Variegated clay	5
1.	White sandstone	4

CLAYS AND CLAY INDUSTRY.

The clays of Jefferson County, which have been used in the manufacture of brick, belong to the Columbia and to the Grand Gulf formations. The Columbia clays are brown or yellow, and may be used in any of the processes of brick manufacture, viz: Soft-mud, stiff-mud or dry-press. The Grand Gulf clays are gray or white, are plastic and contain considerable kaolin.

*Stonington.**—The Stonington Brick Company was organized in 1894, for the manufacture of pressed brick. The plant was recently

*Since this report went to press the Stonington plant has been destroyed by fire.

purchased by Mr. R. J. Searcy and is now operated and managed by him. The clay is prepared in a dry-pan and molded in a dry-press machine. The Columbia clay is used, which produces a red brick. The Grand Gulf clay produces a gray or white brick. By mixing these two clays it is possible to produce a speckled or mottled brick. The bricks are burned in a rectangular, down-draft kiln, in a beehive kiln and in a clamp-kiln. In one portion of the clay-pit the following layers of clay are exposed:

	Section in Stonington Clay-Pit.	Feet.
4.	Brown loam clay	10
3.	Blue clay with white concretions	6
2.	Sandstone in layers	8
1.	Clay, white to gray	8 to 28

In another portion of the clay-pit are fifteen to twenty feet of a shale-like, white to bluish-gray clay. A sample of this clay has the following chemical composition:

TABLE No. 28.

ANALYSIS OF STONINGTON WHITE CLAY.

Moisture (H_2O)	1.24
Volatile matter (CO_2)	4.08
Silica (SiO_2)	78.17
Alumina (Al_2O_3)	13.23
Iron oxide (Fe_2O_3)	1.73
Lime (CaO)	.28
Magnesia (MgO)	.56
Sulphur trioxide (SO_3)	Trace.
Total	99.29

RATIONAL ANALYSIS.

Clay base	33.53
Free silica	57.87
Fluxing impurities	2.57

This clay may be classed as a stoneware clay. In the process of burning it becomes white or yellowish white. It is much more refractory than the brown clay and requires a much higher temperature to produce a hard brick. Its physical properties will be discussed more at length under a discussion of stoneware clays to comprise a future report.

JEFFERSON DAVIS COUNTY.

GEOLOGY.

The Grand Gulf forms the bed-rock of Jefferson Davis County. This formation consists of beds of sands, gravels and gray clays. The eroded sarface of the Grand Gulf is very largely concealed by clays,

gravels and colored sands of the Lafayette and also by the loams of the Columbia. The greater part of the surface clays of the county lies along the divide between Leaf River and Pearl River. In some places the tributaries of these streams have cut through the surficial deposits and exposed the bed-rock.

CLAYS AND CLAY INDUSTRY.

The clay industry of Jefferson Davis County is in an undeveloped condition. Clays suitable for the manufacture of brick are to be found in the surficial formations. The Columbia contains, in some localities, particularly along the slopes of small valleys, beds of clay and loam which, under proper treatment, will be found to be suitable for the manufacture of brick. From the higher lands much of the Columbia has been removed by erosion, so that the soils are formed directly from the Lafayette sands. The Lafayette also contains beds of clays, some of which, with careful treatment, may be utilized in the manufacture of brick. The Grand Gulf clays, when they have been weathered thoroughly, afford good material for brick. The unweathered clays of this formation are not, as a rule, suitable for brick. The usefulness of the Grand Gulf clays is generally very much impaired by the difficulty experienced in drying them.

JONES COUNTY.

GEOLOGY.

The Grand Gulf formation constitutes the bed-rock of Jones County. The strata of the Grand Gulf consist of sands, clays and sandstones; the clays predominate. The town-well at Ellisville passed through the Grand Gulf strata into the underlying formations. The section of this well is given below. At least six hundred feet of the rocks belong to the Grand Gulf.

	Section of Ellisville Well.	Thickness. Feet.	Depth. Feet.
1.	Sand and gravel	80	80
2.	Green clay	280	360
3.	Sand	10	370
4.	Green clay	230	600
5.	Sand rock	12	612
6.	Greenish marl	288	900
7.	Shell rock	5	905
8.	Green marl	195	1,100
9.	Shells	5	1,105
10.	Green marl	295	1,400

The rocks of the Grand Gulf are generally covered with sands and gravels of the Lafayette and the Columbia loams. The bright red sands of the Lafayette are particularly prominent along the divide between Moselle and Ellisville. The Columbia deposits are very thin or entirely wanting on the highest lands where the soils are formed largely from the Lafayette.

CLAYS ANY CLAY INDUSTRY.

The clays of Jones County belong to the Columbia, the Lafayette and the Grand Gulf. The Grand Gulf clays in this county, have not been used with much success in the manufacture of brick. An attempt to make brick was made at Ellisville a few years ago, and while it was possible to mold the bricks, all attempts to dry them successfully failed.

Ellisville.—The local stratigraphy of the surface clays may be seen in the following section taken in a railroad cut north of the station.

	Section at Ellisville.	Feet.
4.	Soil, sandy	1
3.	Yellow loam (Columbia)	3
2.	Yellow sand with some gravel (Lafayette)	3
1.	Clay, greenish-gray (Grand Gulf)	10

The chemical composition of a sample from No. 3 is given below: As will be seen from this analysis this layer of rock contains a very small amount of clay substance. In fact there is not enough clay content for the manufacture of even soft-mud brick. The only way in which it could be utilized would be by the addition of a more plastic clay. Such clays may be found in the residual deposits of the Grand Gulf.

TABLE No. 29.

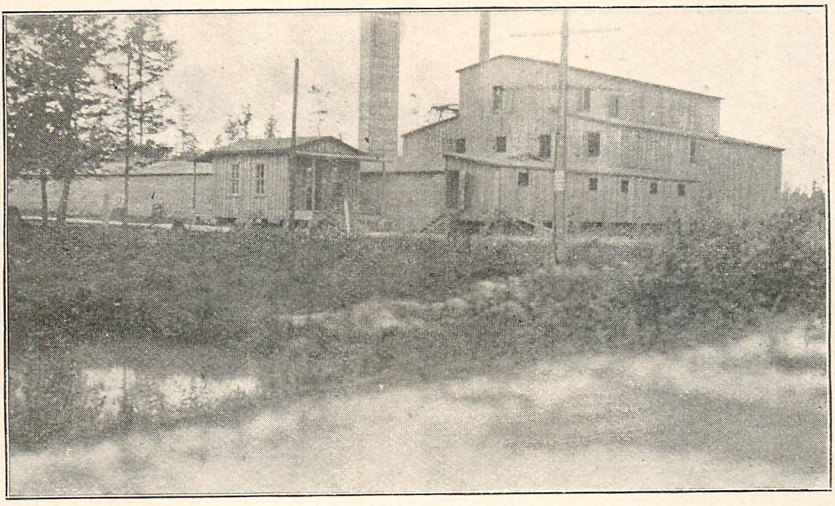
ANALYSIS OF ELLISVILLE CLAY.

	No. 139.
Moisture (H_2O)	0.25
Volatile matter (CO_2, etc.)	1.57
Silicon dioxide (SiO_2)	91.73
Aluminum oxide (Al_2O_3)	0.37
Iron oxide (Fe_2O_3)	2.05
Calcium oxide (CaO)	1.67
Magnesium oxide (MgO)	0.57
Sulphur trioxide (SO_3)	0.13
Total	98.34

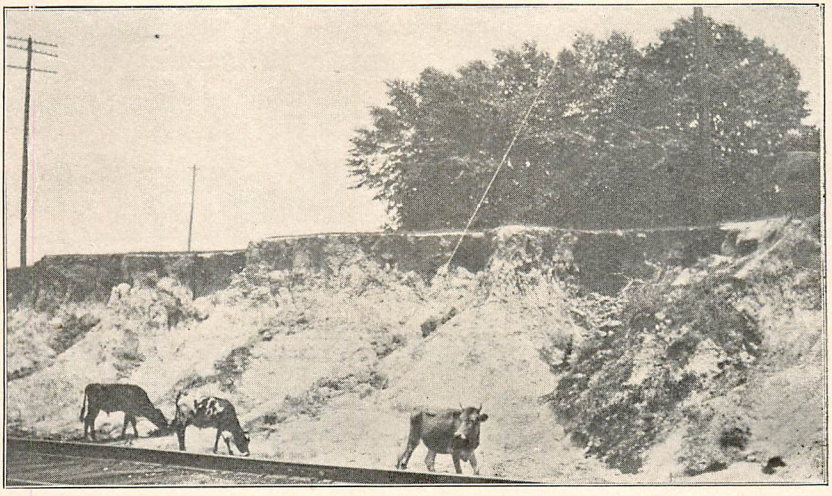
RATIONAL ANALYSIS.

Clay substance	.93
Free silica	91.16
Fluxing impurities	4.23

PLATE XI.



A. PLANT OF THE LAUREL BRICK AND TILE COMPANY, LAUREL.



B. LAFAYETTE OVERLYING GRAND GULF CLAY, ELLISVILLE.

The greenish-gray clay from No. 1 has the following chemical composition:

TABLE No. 30.

ANALYSIS OF ELLISVILLE CLAY.

	No. 138.
Moisture (H_2O)	.85
Volatile matter (CO_2, etc.)	2.64
Silicon dioxide (SiO_2)	81.97
Aluminum oxide (Al_2O_3)	2.95
Iron oxide (Fe_2O_3)	6.17
Calcium oxide	.92
Magnesium oxide (MgO)	.15
Sulphur trioxide (SO_3)	.21
Total	95.86

RATIONAL ANALYSIS.

Clay substance	7.46
Free silica	77.46
Fluxing impurities	7.45

This clay is also deficient in clay content. It contains a large per cent of silica in the form of a very finely-divided sand. The difficulties of molding the clay are not great; but the molded brick cannot be dried successfully. Because of the already small amount of clay substance further dilution by the addition of sand would destroy the bonding power of the clay.

Laurel.—The Laurel Brick and Tile Company was organized in 1900. In 1907 the location of the plant was changed and new machinery installed. The clay is tempered in a horizontal pug-mill. It is then molded in a stiff-mud machine, and the bricks separated by the use of an end-cutter. The bricks are dried in a steam-dryer and burned in up-draft, clamp-kilns.

The clay-pit contains a yellow, sandy, top clay; below this is a bluish-gray clay which rests upon sand, the sand in turn resting upon a greenish clay. A sample of the gray clay has the following composition:

TABLE No. 31.

ANALYSIS OF LAUREL GRAY CLAY.

	No. 75 O. S.
Moisture (H_2O)	1.22
Volatile matter (CO_2, etc.)	3.66
Silicon dioxide (SiO_2)	84.86
Aluminum oxide (Al_2O_3)	5.28
Iron oxide (Fe_2O_3)	3.96
Calcium oxide (CaO)	0.23
Magnesium oxide (MgO)	0.45
Sulphur trioxide (SO_3)	0.00
Total	99.66

RATIONAL ANALYSIS.

Clay substance	13.38
Free silica	78.76
Fluxing impurities	4.64

The clay requires 24 per cent of water to render it plastic. It has a specific gravity of 2.62. The average tensile strength of the air-dried briquets is 70 pounds per square inch. The air-shrinkage is 2 per cent. The color of the burned product is red.

LAMAR COUNTY.

GEOLOGY.

The bed-rock of Lamar County belongs to the Grand Gulf group. A large part of the surface of the bed-rock is concealed by a mantle of Lafayette and Columbia. The Lafayette is represented by orange-colored sands which contain lenticular bodies of clay, and in some localities quantities of water-worn gravels. The Columbia forms a thin mantle of loam which is sandy in the upper portions, but is of a clayey nature in the lower part. The Grand Gulf stratigraphy is revealed by the well-record of the Camp-Hinton Lumber Company at Lumberton.

General Section of Camp-Hinton Well, Lumberton.

		Thickness. Feet.	Depth. Feet.
1.	Surface and sand clay	40	40
2.	Water-bearing sand and gravel	5	45
3.	White clay and fine sand	650	695
4.	Blue and green clays	200	895
5.	Blue clay and sand	505	1,400
6.	Soft blue clay and sand	400	1,800

CLAYS AND CLAY INDUSTRY.

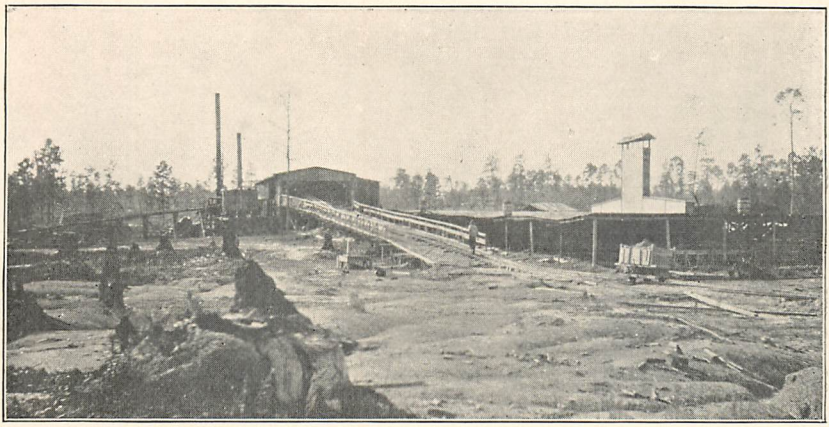
Lumberton.—At Lumberton the Lafayette mottled clays are being used by the Lumberton Brick Manufacturing Company in the manufacture of stiff-mud brick. For a number of years the Columbia loam was used in the manufacture of brick by the soft-mud process. The plant was established in 1895. Ten years later, 1905, a new company was organized and new machinery installed.

The surface clay rests on the greenish-gray Grand Gulf clays and is probably a residual product of that formation. The yellow, sandy deposit of the Columbia mantles the Lafayette clays. The clay-pit exhibits the following layers:

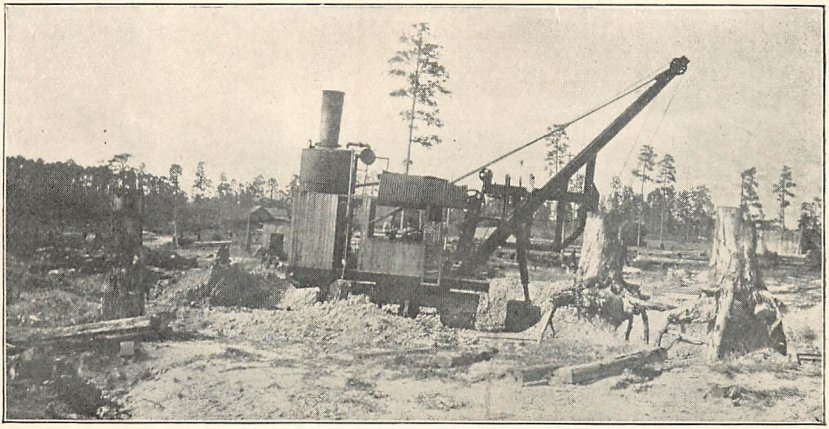
Clay-Pit of the Lumberton Brick Company, Lumberton.

		Feet.
3.	Yellow loam (Columbia)	3 to 4
2.	Mottled clay (Lafayette)	5 to 6
1.	Greenish-gray clay (Grand Gulf)	5

PLATE XII.

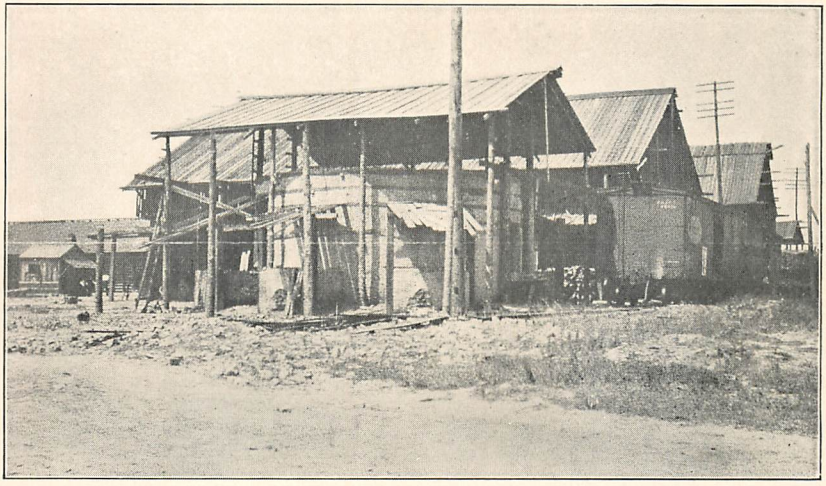


A. PLANT OF THE LUMBERTON BRICK MANUFACTURING COMPANY, LUMBERTON.

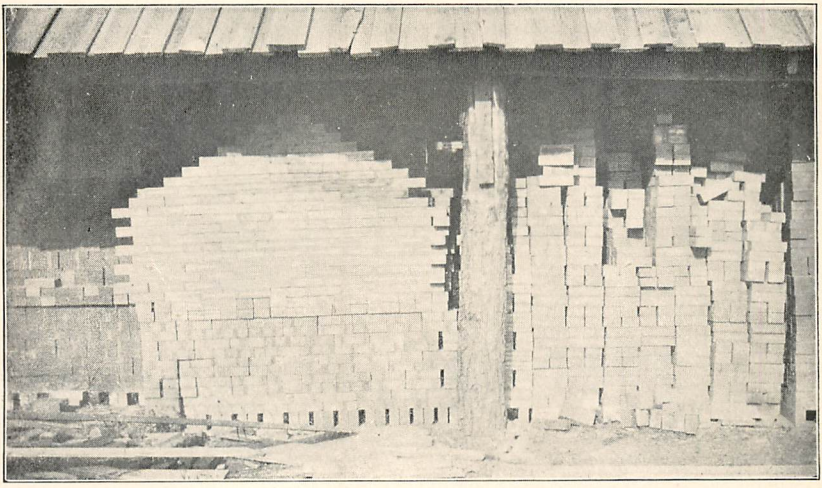


B. STEAM-SHOVEL USED BY THE LUMBERTON BRICK MANUFACTURING COMPANY, LUMBERTON.

PLATE XIII.



A. BRICK PLANT OF A. SEAVEY AND SONS, BROOKHAVEN.



B. FLASHED BRICK MADE BY THE BROOKHAVEN PRESSED BRICK COMPANY, BROOKHAVEN.

The clay is mined by the use of a steam shovel, and transported to the clay machine by means of cars controlled by drum and hoist. It is tempered in a pug-mill and molded in a stiff-mud machine. The bricks are dried in open sheds and in steam-driers and burned in rectangular up-darft kilns of the clamp-type.

LAWRENCE COUNTY.

GEOLOGY.

Lawrence County lies within that portion of the State which is underlain by Grand Gulf strata. Clays, sands and gravels form the principal constituents of the group. The bed-rock is mantled by deposits of Lafayette, Columbia and the alluvium of Pearl River Valley.

CLAYS AND CLAY INDUSTRY.

There has been no development of the brick industry in Lawrence County. Suitable clays for brick manufacture may be found in the two surface formations. The Lafayette sandy clays may be used in the manufacture of brick by the soft-mud process. The more plastic clays of the Columbia and the residual clays of the Grand Gulf will be found suitable for the manufacture of stiff-mud brick. On account of the fineness of grain of the free silica in the Grand Gulf, great care in drying is necessary in order to prevent cracking.

LINCOLN COUNTY.

GEOLOGY.

Lincoln County lies within the area of the Grand Gulf group. The mantle-rock consists of beds of gravel, sands and loams belonging to the Lafayette and the Columbia. The Lafayette beds, as a rule, do not exceed fifty feet in thickness, while the Columbia is rarely ever half that thickness. Sands and gravels comprise the major part of the Lafayette, but there are also beds of red, mottled-red and white clays which lie normally at the base of the formation. On the high ridges between the streams the Columbia has been removed in many places and the soils are formed directly from the Lafayette.

CLAYS AND CLAY INDUSTRY.

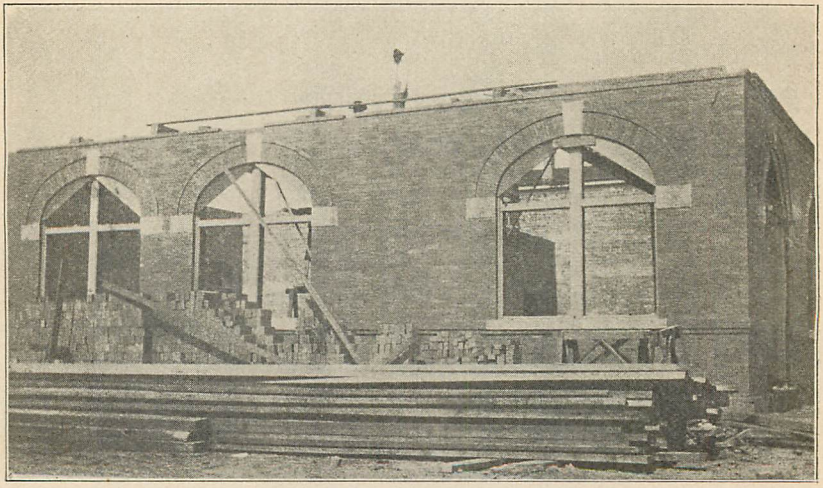
The clays which have thus far been used in Lincoln County for the manufacture of brick belong to the Columbia. Bricks have been manufactured at Brookhaven and Norfield.

Brookhaven.—Messrs. A. C. Seavey and Sons established a plant for the manufacture of brick at Brookhaven in the year 1892. The clay used is a yellowish-brown, surface clay. It is tempered in ring-pits and molded by hand. The bricks are dried in covered sheds by pallet and rack-system. Two kinds of up-draft kilns are used, round and rectangular.

The plant of the Brookhaven Pressed Brick Company was established in 1906. A surface clay of Columbia age is used in making brick. The clay is pulverized in a dry-pan and carried by a conveyor to a screen, after which it passes to an agitator and from the agitator to the press. The bricks are burned in rectangular, up-draft kilns.

Norfield.—At Norfield the surface-loam clay is used in the manufacture of brick by the Norfield Brick Manufacturing Company. The present plant was established in 1905. The clay is crushed by the use of a granulator and disintegrator, and tempered in a horizontal pug-mill. The clay is molded in a steam-power, soft-mud machine. The bricks are placed upon pallets and dried in sheds. The bricks are burned in rectangular up-draft kilns of the clamp variety.

PLATE XIV.



BUILDING CONSTRUCTED OF BROOKHAVEN PRESSED BRICK, SILVER CREEK.

MARION COUNTY.

GEOLOGY.

The bed-rock formations of Marion County are of Grand Gulf age. The surficial deposits of the county belong to the Lafayette, the Columbia and the alluvium of Pearl River Valley. The Grand Gulf strata consist of clays, claystones, sands and gravels. A gravel-layer, which probably belongs to the Grand Gulf, at Columbia, has a thickness of 168 feet. The following analyses are from samples of Grand Gulf clays; the first was taken from Burnett's Bluff and the second from Barnes' White Bluff:

TABLE No. 32.

ANALYSES OF GRAND GULF CLAYS.

	No. 1.	No. 2.
Insoluble matter	83.691	77.438
Alumina	8.347	6.449
Lime	.793	4.800
Potash	.827	.709
Soda	.268	.101
Magnesia	1.053	1.248
Brown oxide of manganese	.223	.316
Peroxide of iron	4.394	2.989
Phosphoric acid	.148	.111
Sulphuric acid	.022	Trace.
Carbonic acid	. 00	3.372
Organic matter and water	. 00	2.554
Total	99.766	100.087

CLAYS AND CLAY INDUSTRY.

Columbia.—The Columbia clays are being used in the manufacture of brick by the soft-mud process, at a point about one mile north of Columbia in Pearl River Valley.

PERRY COUNTY.

GEOLOGY.

The bed-rocks of Perry County belong to the Grand Gulf group. These rocks outcrop along the courses of the streams. They consist of greenish-colored clays, with an alum-like taste, and of white sands. The orange-colored sands of the Lafayette and the yellow loams of the Columbia constitute the principal surficial deposits. The alluvium of the river valleys is composed largely of the worked-over materials of these two formations.

CLAYS AND CLAY INDUSTRY.

The clay-bearing formations of the county are the Grand Gulf, the Lafayette and the Columbia. The clay industry has received very little attention as yet. Brick clays may be found in the Lafayette and the Columbia formations.

Out-crops of Grand Gulf clays are exposed along the courses of the streams, and in some places in railroad cuts. Exposures of the latter type are to be found near Beaumont. These clays are greenish-gray in fresh exposures, but weather to red or yellow in residual deposits. This condition is brought about largely by the decomposition of marcasite, which is present in the clay. The weathered clay of the Grand Gulf could be used in many places in the manufacture of brick. There are some out-crops which contain a very high per cent of finely divided silica. These clays not only lack bonding power, but they present difficulties in drying.

PEARL RIVER COUNTY.

GEOLOGY.

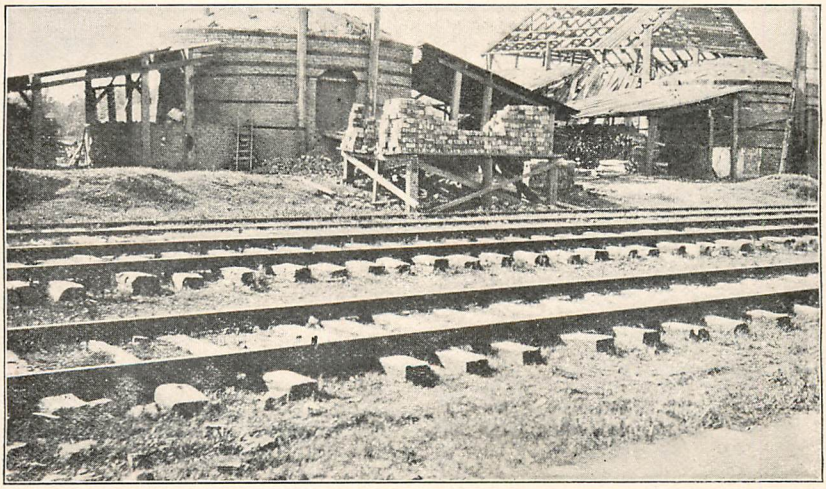
Pearl River County lies within the Grand Gulf area. The surficial rocks belong to the Lafayette and to the Columbia. Along Pearl River Valley there are also more recent deposits of alluvium. At Poplarville, one of the highest points between New Orleans and Meridian, the Lafayette deep-red sands have a thickness of about fifty feet. There is considerable gravel in the lower part of the formation, and the shallow wells obtain their water-supply from this gravel-layer. The quantity of gravel varies from point to point. The Grand Gulf clays are exposed along the branches of Abolo Chitto and other streams. The clays are often interstratified with beds of lignite or lignitic clay. Such beds are usually thin and contain considerable quantities of iron pyrites.

CLAYS AND CLAY INDUSTRY.

Lacy.—The surface clays of Pearl River County have been used in the manufacture of brick at Lacy. The clay was tempered in soaking pits and molded by hand. The bricks were dried in open yards and burned in scove kilns. The clay used belongs to the Columbia. It is of a light yellow color and of a sandy type. The Lafayette clays occur in

PLATE XV.

A. LAFAYETTE CAPPED WITH COLUMBIA LOAM, NEAR WOODVILLE.



B. FERRELL BRICK KILNS, OSYKA.

abundance in this county, and, doubtless, many of the out-crops contain clays suitable for the manufacture of brick. The Grand Gulf clays are, as a rule, not suitable for the manufacture of brick because of the difficulty in drying, but the residual clay of the Grand Gulf may be used n making common brick.

Caledonia.—Out-crops of Grand Gulf clay occur in railroad cuts on the New Orleans and North Eastern Railroad at Caledonia. The unweathered clays are not suitable for the manufacture of brick.

PIKE COUNTY.

GEOLOGY.

Grand Gulf strata underlie the surface of Pike County. The surface of the Grand Gulf is mantled with Lafayette and Columbia. The gray clays of the bed-rock are found in the sides and bottoms of the ravines which dissect the divides between the stream-courses. The Lafayette-reddish sands and clays contain large numbers of water-worn pebbles in some outcrops. The Columbia formation does not appear as thick here as in the counties nearer the Mississippi River.

CLAYS AND CLAY INDUSTRY.

The clays of Pike County, which have been used in the manufacture of brick, are surface clays belonging to the Columbia formation. The other clay-bearing formations are the Lafayette and the Grand Gulf.

Summit.—The plant of the Summit Brick Manufacturing Company was established in 1906. The clay used is a yellow, surface clay. It is brought from the pit by the aid of cable cars elevated by drum and hoist. The clay is pulverized by a granulator and a disintegrator. It is then tempered in a pug-mill and molded in a soft-mud machine, operated by steam-power. The bricks are dried on pallets in covered racks and are burned in clamp-kilns.

McComb City.—The White and Mey Brick Manufacturing Company established a plant at McComb City in 1897. A yellowish-gray, surface clay is used, which is transported to the plant by cars propelled by steam power. The clay is pulverized in a granulator and a disintegrator. It is tempered by passing it through two pug-mills. The bricks are molded in a soft-mud, steam-power machine. They are dried in shed-driers and burned in clamp-kilns of rectangular shape.

Fernwood.—The Fernwood Lumber Company began the manufacture of brick in 1890. The material used is a surface clay obtained from a small creek valley. It is probably of Columbia age. The clay is excavated by means of a steam shovel and hauled on small cars propelled by steam power. It is pulverized by the use of a disintegrator and a granulator. It is tempered by passing through two pug-mills, and is molded in a soft-mud, steam-power machine. The bricks are placed on pallets and dried in covered racks. They are burned in large, rectangular, clamp-kilns.

Osyka.—The Neff and Owen Brick Company of Osyka uses a yellow surface clay in the manufacture of brick. The clay is tempered in a ring-pit and molded by hand. The bricks are burned in rectangular and bee-hive up-draft kilns. The plant was established in 1892.

In 1897 Mr. S. R. Ferrell established a brick plant at Osyka. A surface clay is employed in the manufacture of brick by the soft-mud process. The clay is tempered in a ring-pit and molded by hand. The bricks are dried in sheds and burned in up-draft kilns of the bee-hive type.

Mr. J. C. Wilson began the manufacture of brick at Osyka in 1899. The method of treating the clay is the same as in the other two plants.

Magnolia.—In 1892 S. Cohn and Sons began the manufacture of brick at Magnolia. The bricks are manufactured by the soft-mud process. The clay is tempered in a ring-pit and molded by hand. The bricks are burned in rectangular, up-draft kilns.

SIMPSON COUNTY.

GEOLOGY.

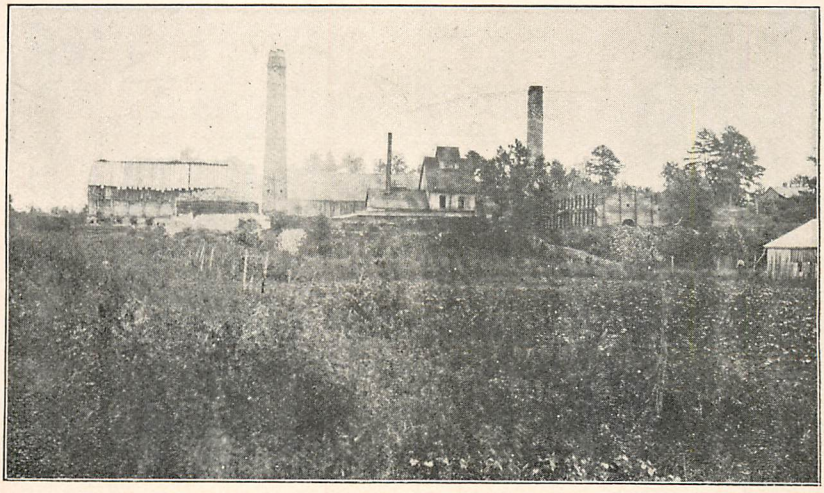
The bed-rock of Simpson County belongs to the Grand Gulf formation. The mantle-rock consists of Lafayette sands and gravels, Columbia loam and residual material from the older rocks.

CLAYS AND CLAY INDUSTRY.

The clays which may be utilized in the manufacture of brick in Simpson County belong to the mantle-rock and to the residual materials from the bed-rock. The Grand Gulf contains thick beds of clay, but these are not always suitable for the manufacture of brick until they have been properly weathered.

PLATE XVI.

A. GRAND GULF IN CREEK-BANK AT GOLDEN'S WATER MILL, TAYLORSVILLE.



B. STONINGTON BRICK MANUFACTURING PLANT, STONINGTON.

SMITH COUNTY.

GEOLOGY.

The northeastern part of Smith County is underlain by Jackson sands, clays and marls. The bed-rock of the central portion of the county is composed of Vicksburg limestone; the southern portion of the county is underlain by Grand Gulf strata. The bed-rock is mantled by deposits of Lafayette and Columbia and the residual materials of the bed-rock formations. In some localities the Lafayette has a white, chalk-like clay at the base. On Dr. Weatherby's farm, north of Taylorsville, the white clay is said to have a thickness of sixteen feet. On Deer Creek, at Taylorsville, layers of white sandstone of Grand Gulf age are overlain by variegated clays of Lafayette, over which is a layer of yellow sand or sandy loam (Columbia). The undrained areas of the Columbia contain a gray clay, with iron concretions called "buckshot."

CLAYS AND CLAY INDUSTRY.

The clay industry of Smith County has been but little developed. The clay-bearing formations are the Lafayette, the Grand Gulf, the Jackson and the Columbia.

Taylorsville.—Mr. G. Bustin at one time operated a brick plant at Taylorsville. The bricks were molded by the stiff-mud process. The material used was a mixture of yellow, surface clay, and a plastic clay from the Lafayette. The latter was taken from a pit at a depth of twenty feet below the surface. After an accident caused by the caving of the walls of the pit the plant was abandoned.

In 1906 Mr. M. S. Golden burned a kiln of soft-mud brick on his farm on Deer Creek. The following geological section is exposed near the pit:

Section on Deer Creek, Golden's Mill.

		Feet.
4.	Soil, sandy	1 to 2
3.	Loam, sandy (Columbia)	5
2.	Clay, variegated and stratified	5
1.	Sandstone, white	12

The clay from No. 2 was used in the manufacture of brick. It is deficient in bonding material on account of too much sand. A more plastic clay should be added to this in order to make a good brick.

The white Lafayette clay from the Weatherby farm, referred to above, has been used in the manufacture of brick and tile. Two

chimneys of a store building in Taylorsville were built of white bricks from that place. The bricks are said to be capable of withstanding a very high temperature. The composition of a sample of the clay is as follows:

TABLE No. 33.

ANALYSIS OF WHITE, LAFAYETTE CLAY FROM NEAR TAYLORSVILLE.

	No. 74 O. S.
Moisture (H_2O)	1.28
Volatile matter (CO_2, etc.)	6.60
Silicon dioxide (SiO_2)	71.29
Aluminum oxide (Al_2O_3)	16.78
Iron oxide (Fe_2O_3)	3.30
Calcium oxide (CaO)	0.14
Magnesium oxide (MgO)	0.41
Sulphur trioxide (SO_3)	Trace.
Total	99.80

RATIONAL ANALYSIS.

Clay substance	42.52
Free silica	45.55
Fluxing impurities	3.85

This clay requires 17 per cent of water to render it plastic. The shrinkage in air-drying is 5 per cent. Its specific gravity is 2.23 per cent. The unburned briquets have an average tensile strength of 100 pounds per square inch.

Burns.—Mr. T. B. Winstead of Burns uses a surface clay in the manufacture of brick. He uses the soft-mud process of molding and burns in scove kilns.

WAYNE COUNTY.

GEOLOGY.

The sub-strata of the northeastern part of Wayne County belong to the Jackson group. The area of the Jackson out-crop is marked by sticky lime soils and patches of bald prairie. The central part of the county is underlain by the Vicksburg limestone. The solvent action of ground water has produced a number of small caves in the rocks of this group. The largest of these is King's Cave, about seven miles northwest of Waynesboro, on Mr. Pitt's farm.

The Grand Gulf strata form the sub-surface of the southern portion of the county. The rocks of this group consist of white and red sands and bluish clays containing lignitized remains of trees.

The red sands and the variegated clays of the Lafayette form the principal mantle-rocks of the county. Along the divide between the

Chickasawhay River and Buckatuna Creek the hills are capped with Lafayette sands and ironstones. The Columbia loam is also present, mantling the older formations in most places. Two types are recognizable, gray and brown.

The analyses of two samples of Jackson marl, one from Chickasawhay River at Davis Ferry and the other from Limestone Creek are here given.

TABLE No. 34.

ANALYSES OF JACKSON MARLS, FROM WAYNE COUNTY.

	No. 1.	No. 2.
Insoluble matter	55.185	56.787
Alumina	1.956	.855
Lime	19.508	20.793
Potash	.621	.369
Soda	.129	.178
Magnesia	.950	.833
Brown oxide manganese	.192	.032
Peroxide of iron	1.194	1.928
Phosphoric acid	.080	.121
Sulphuric acid	1.804	.085
Carbonic acid	17.662	16.273
Organic matter and water	00.000	1.100
Total	99.666	99.351

A sample of Vicksburg marl from Lang's mill, in Wayne County, was analyzed with the following results:

TABLE No. 35.

ANALYSIS OF VICKSBURG MARL, WAYNE COUNTY.

Insoluble matter	23.282
Alumina	2.726
Lime	37.633
Potash	.295
Soda	.255
Magnesia	1.188
Brown oxide of manganese	.088
Peroxide of iron	2.200
Phosphoric acid	.119
Sulphuric acid	.312
Carbonic acid	29.500
Organic matter and water	2,524
Total	100.122

CLAYS AND CLAY INDUSTRY.

The clay-bearing formations of Wayne County are Jackson, Grand Gulf, Lafayette and Columbia. The last two named are being utilized in the manufacture of brick. The Lafayette clay is usually a stiff, reddish-colored clay. The Columbia is the surface formation. It is of a loamy nature, with a clay sub-stratum.

PLATE XVII.

B. POWER PLANT OF THE WAYNESBORO BRICK COMPANY, WAYNESBORO.

Waynesboro.—The Waynesboro Brick and Manufacturing Company uses a mixture of Lafayette clay and Columbia loam in the manufacture of brick. The plant was established in 1906 with Mr. H. H. Moore as superintendent. The stratigraphy of the clay-pit is as follows:

Section of Waynesboro Clay-Pit.

		Feet.
3.	Soil, about	1
2.	Columbia loam	2 to 3
1.	Lafayette clay, about	12

The total thickness of No. 1 is not revealed in the pit, but is said to be twelve feet thick in the well located in the yard. The well is eighteen feet deep, with sixteen feet of clay and two feet of sand. The sixteen-foot bed of clay is prepared by crushing in a granulator and disintegrator and tempering in a pug-mill. It is then molded in a stiff-mud machine of the horizontal, auger-type, and the bricks cut with an end-cut machine. The bricks are stacked in rows under covdered racks and dried. They are then burned in up-draft, clamp-kilns.

Analyses of Lafayette clay and Columbia clay used in these bricks are given below. No. 1 is from the Lafayette and No. 2 is from the Columbia:

TABLE No. 36.

ANALYSES OF WAYNESBORO CLAYS.

	No. 1.	No. 2.
Moisture (H_2O)	1.98	1.53
Volatile matter (CO_2, etc.)	5.13	2.37
Silicon dioxide (SiO_2)	75.12	83.33
Aluminum Oxide (Al_2O_3)	10.75	8.00
Iron oxide (Fe_2O_3)	4.57	3.50
Calcium oxide (CaO)	0.32	0.67
Magnesium oxide (MgO)	0.03	0.09
Sulphur trioxide (SO_3)	1.70	0.25
Total	99.60	99.94
RATIONAL ANALYSES.		
Clay substance	27.19	20.24
Free silica	58.68	71.29
Fluxing impurities	6.62	4.51

WILKINSON COUNTY.

GEOLOGY.

The bed-rock formation of Wilkinson County is of Grand Gulf age. The Grand Gulf rocks on the higher lands of the county are largely concealed by beds of gravel, sand and clay of Lafayette age and by the Columbia loams. Along the bluffs of the Mississippi River the older formations are mantled with a deposit of loess. The flood-plain area of the river is covered with alluvial silts of recent age. The bluffs of the Mississippi and Buffalo Bayou are composed of Grand Gulf and younger strata.

Dr. Hilgard, in his report on the geology of Mississippi, p. 150, gives the following section, which represents the stratigraphical condition of these bluffs:

Section at Loftus Heights, Fort Adams, Wilkinson County.

		Feet.
3.	Yellowish-gray, calcareous silt of Bluff formation (loess)	73
2.	Orange sand—yellow, orange and white sands	87
1.	Argillaceous sandstone, yellowish-gray in its mass, variegated with furruginous spots and veins, and of different degrees of hardness, so as to weather into rough, jagged surfaces. Traceable to water's edge	170

No. 3 represents the loess; No. 2 is Lafayette, at least in part, though a portion of the stratum may belong to the Grand Gulf; No. 1 is Grand Gulf.

CLAYS AND CLAY INDUSTRY.

The clays which have thus far been used in the manufacture of brick in Wilkinson County are surface clays of the Columbia formation.

Suitable clays for brick manufacture may be found also in the Lafayette and in the residual clays of the Grand Gulf. Bricks are now being manufactured at two points, Centerville and Woodville.

Centerville.—The Centerville Brick Manufacturing plant is owned and managed by Mr. G. W. Haag. The plant was established in 1897. The clay is prepared in a disintegrator and molded in a stiff-mud, end-cut machine. The bricks are stacked in sheds for drying. They are then burned in clamp kilns. The clay-bed has a thickness of about ten feet, the upper six feet of which is used for making brick. The bed of clay rests upon a layer of sand, the whole having a thickness of fifty-six feet, according to the record of a nearby well.

Woodville.—Mr. E. B. Arthur established a plant for the manufacture of brick at Woodville in 1903. The clay is tempered in a ring-pit. The bricks are molded by hand and burned in clamp kilns. The clay-pit exhibits a layer of sandy, Lafayette clay, capped with a brown loam (Columbia.) The full section of the clay is used from top to bottom.

TABLE No. 37.

SPECIFIC GRAVITY OF SOME MISSISSIPPI BRICK CLAYS.

Locality.	Formation.	Specific Gravity. Raw Clay.	Burned Clay
Agricultural College, No. 1	Residual Selma	2.18	2.20
Agricultural College, No. 2	Residual Selma	2.21	2.22
Agricultural College, No. 3	Residual Selma	2.13	2.45
Aberdeen	Lafayette	2.12	2.30
Amory	Lafayette	2.20	2.20
New Albany	Lafayette	2.15	2.36
Batesville	Columbia	2.10	2.40
Canton	Jackson	1.91	2.30
Canton	Lafayette	2.27	2.27
Clarksdale	Alluvium	1.93	2.11
Corinth	Residual Selma	2.20	2.22
Grenada	Columbia	2.04	2.31
Hampton	Alluvium	1.93	2.11
Hernando	Columbia	2.20	2.28
Holly Springs	Columbia	2.17	2.50
Houlka	Columbia	2.21	2.33
Indianola	Alluvium	1.90	2.15
Tchouticabouff River	Columbia	1.83	2.28
Macon	Porter's Creek	2.28	2.31
Morton	Jackson	2.12	2.22
Newton	Lafayette	2.00	2.31
Ocean Springs	Columbia	1.92	2.11
Pontotoc	Lafayette	2.33	2.25
Rienzi	Columbia	2.11	2.40
Ripley	Columbia	1.17	2.23
Vaiden	Claiborne	1.45	2.00

DIRECTORY OF MISSISSIPPI BRICK MANUFACTURERS.

	Name of Firm.	*Locality.*	*County.*
1.	Austin Brick Mfg. Co	Pontotoc	Pontotoc.
2.	Bacon Brick Mfg. Co	Greenwood	Leflore.
3.	Baldwyn Brick and Tile Co	Baldwyn	Lee.
4.	Beck Brick Mfg. Co	Vicksburg	Warren.
5.	Bledsoe Brick and Tile Co	Grenada	Grenada.
6.	Bonita Brick and Tile Co	Meridian	Lauderdale.
7.	Booneville Brick and Tile Co	Booneville	Prentiss.
8.	Brown Brick Mfg. Co	Crenshaw	Panola.
9.	Brookhaven Pressed Brick Co	Brookhaven	Lincoln.
10.	Blumer Brick Mfg. Co	Moss Point	Jackson.
11.	Buchanan Brick Co	Sardis	Panola.
12.	Bushman and McGinnis Brick Co	Hattiesburg	Forrest.
13.	Butler Brick Mfg. Co	New Albany	Union.
14.	Camp Brick Mfg. Co	Amory	Monroe.
15.	Carl Brick Mfg. Co	Grenada	Grenada.
16.	Centerville Brick Co	Centerville	Wilkinson.
17.	Charleston Improvement and Investment Co.	Charleston	Tallahatchie.
18.	Clarksdale Brick and Tile Co	Clarksdale	Coahoma.
19.	Cline Brick Mfg. Co	Macon	Noxubee.
20.	Coffeeville Brick Co	Coffeeville	Yalobusha.
21.	Columbus Brick Mfg. Co	Columbus	Lowndes.
22.	Concord Brick Mfg. Co	Natchez	Adams.
23.	Corinth Brick Mfg. Co	Corinth	Alcorn.
24.	Crymes Brick Mfg. Co	Hattiesburg	Forrest.
25.	Edwards Brick Mfg. Co	Edwards	Warren.
26.	Erby Bros. Brick Co	Holly Springs	Marshall.
27.	Fernwood Lumber Co	Fernwood	Pike.
28.	Ferrell Brick Mfg. Co	Osyka	Pike.
29.	Furtick Brick Co	Rienzi	Alcorn.
30.	Garbish Brick Mfg. Co	Vicksburg	Warren.
31.	Greenville Brick Mfg. Co	Greenville	Washington.
32.	Gregory Brick Mfg. Co	Vicksburg	Warren.
33.	Gloster Brick Mfg. Co	Gloster	Amite.
34.	Gulo Brick Mfg. Co	Holcomb	Grenada.
35.	Hancock Brick Mfg. Co	Newton	Newton.
36.	Hawkins and Hodges Brick Co	Okolona	Chickasaw.
37.	Hazlehurst Brick Mfg. Co	Hazlehurst	Copiah.
38.	Howard Brick Mfg. Co	Starkville	Oktibbeha.
39.	Imperial Brick Company	Biloxi	Harrison.
40.	Indianola Brick and Tile Co	Indianola	Sunflower.
41.	Jesty Brick and Lumber Co	Winona	Montgomery.
42.	Langley Bros. Brick Co	Louisville	Winston.
43.	Laurel Brick and Tile Co	Laurel	Jones.
44.	Leakesville Brick Co	Leakesville	Greene.
45.	Liberty Brick Mfg. Co	Liberty	Amite.
46.	Landon Brick and Tile Co	Landon	Harrison.
47.	Love Wagon Co	Durant	Holmes.
48.	Lowery and Berry Brick Co	Blue Mountain	Tippah.
49.	Maben Brick Mfg. Co	Maben	Oktibbeha.
50.	Magnolia Brick Mfg. Co	Magnolia	Pike.
51.	Meadville Brick Mfg. Co	Meadville	Franklin.
52.	Montgomery Brick Mfg. Co	Senatobia	Tate.
53.	Montgomery Land and Brick Co	Yazoo City	Yazoo.

DIRECTORY OF MISSISSIPPI BRICK MANUFACTURERS—Continued.

	Name of Firm.	*Locality.*	*County.*
54.	Mt. Olive Brick Mfg. Co	Mt. Olive	Covington.
55.	Natchez Brick Mfg. Co	Natchez	Adams.
56.	Nettleton Brick Mfg. Co	Nettleton	Lee.
57.	Neff and Owen Brick Mfg. Co	Osyka	Pike.
58.	New Houlka Brick Mfg. Co	New Houlka	Chickasaw.
59.	Norfield Brick Mfg. Co	Norfield	Lincoln.
60.	Norris Brick Mfg. Co	Water Valley	Yalobusha.
61.	Oktibbee Brick Mfg. Co	Meridian	Lauderdale.
62.	Oxford Brick and Tile Co	College Hill	Lafayette.
63.	Orange Groove Brick Co	Orange Groove	Jackson.
64.	Pope Brick Mfg. Co	Houston	Chickasaw.
65.	Port Gibson Mfg. Co	Port Gibson	Claiborne.
66.	Quitman Brick Mfg. Co	Quitman	Clarke.
67.	Rheinhart Brick and Tile Co	Clarksdale	Coahoma.
68.	Ripley Brick Mfg. Co	Ripley	Tippah.
69.	Riverside Brick Mfg. Co	Hattiesburg	Forrest.
70.	Robinsonville Brick and Tile Co	Robinsonville	Tunica.
71.	Ruffin Brick Co	Columbia	Marion.
72.	Saltillo Brick Mfg. Co	Saltillo	Lee.
73.	Seavey and Sons Brick Mfg. Co	Brookhaven	Lincoln.
74.	Smith Brick Mfg. Co	Canton	Madison.
75.	Storer and Miller Brick Co	Louisville	Winston.
76.	Storer and Miller Brick Co	Kosciusko	Attala.
77.	Stonington Brick Mfg. Co	Stonington	Jefferson.
78.	Success Brick and Tile Co	Greenwood	Leflore.
79.	Summit Brick Mfg. Co	Summit	Pike.
80.	Sunflower Brick Mfg. Co	Indianola	Sunflower.
81.	Tanner Brick Mfg. Co	Vicksburg	Warren.
82.	Taylor and Thomas Brick Mfg. Co	Crystal Springs	Copiah.
83.	Taylor Brick Mfg. Co	Jackson	Hinds.
84.	Thrasher Brick Mfg. Co	Thrasher	Prentiss
85.	Thornton Brick Mfg. Co	Vicksburg	Warren
86.	Tubbs Brick Mfg. Co	Amory	Monroe
87.	Union County Brick Co	New Albany	Union
88.	Utica Brick Mfg. Co	Utica	Hind .
89.	Vaiden Brick and Tile Co	Vaiden	Carroll.
90.	Valley Brick and Tile Co	Lakeview	DeSoto.
91.	Vardaman Brick Co	Vardaman	Calhoun.
92.	Verona Brick Mfg. Co	Verona	Lee.
93.	Waynesboro Brick Mfg. Co	Waynesboro	Wayne.
94.	Weems Brick Co	Sun	Scott.
95.	Welch-Trotter Brick Co	West Point	Clay.
96.	West Point Brick Mfg. Co	West Point	Clay.
97.	White and Mey Brick Co	McComb City	Pike.
98.	Wilson Brick Mfg. Co	Osyka	Pike.
99.	Winstead Brick Co	Burns	Smith.
100.	Woodville Brick Mfg. Co	Woodville	Wilkinson.

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In the list given above are some of the more important works on the subject of clay. Some of those named are not given because of their importance as reference works on the subject of clay, but because they have a bearing upon the subject of Mississippi geology or clays. No attempt has been made to give a complete bibliography or to make complete the list of writings of any one author. Nearly all the articles on clay have been published in the reports of State geological surveys and are accessible to the clay-worker.

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INDEX.