

Mississippi State Geological Survey

E. N. LOWE, DIRECTOR

BULLETIN No. 9

THE
Structural Materials of Mississippi
A Preliminary Report



BY
WILLIAM N. LOGAN

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LETTER OF TRANSMITTAL.

JACKSON, MISS., Dec. 10, 1911.

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

GENTLEMEN: I herewith submit a report on the Structural Materials of Mississippi, by Dr. Wm. N. Logan, and recommend its publication as Bulletin No. 9 of the Mississippi Geological Survey.

Very respectfully,

E. N. LOWE,
Director.

STATE GEOLOGICAL COMMISSION.

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INTRODUCTION.

The rapid industrial development of Mississippi, particularly during the past decade, has created a notable demand for all kinds of structural materials. It is a condition much to be deplored that these demands are being satisfied largely from sources outside the boundaries of the State. Aside from lumber, common building brick and very limited quantities of sand and gravel for concrete work, we are the importers rather than the producers of building materials. To one having at heart the best interests of the State, it is a source of regret that, although the State has abundant materials for the manufacture of Portland cement, not a pound is, at present, manufactured within its borders. Neglected also have been our gravels and sands for concrete and road metal, our building stones and our chert and clay deposits.

The rapidity with which our timber resources are being exhausted indicates that we must, of necessity, rely more and more upon other classes of structural materials. Therefore, the development of such other natural resources of this nature, as the State may possess, becomes of paramount importance. The building of roads and the paving of streets calls for cheap, serviceable road metal. The use of concrete as a structural material is becoming vastly more extensive and large quantities of good sand, gravel and cement are required for its manufacture. The object of the investigations, upon which this preliminary report is based, was to extend our knowledge of the quantity and quality of these and other structural materials. For we realize that the more publicity that is given these resources, the more rapidly they will be developed.



PLATE 1.—Sub-Carboniferous Sandstone near Gardner Place in Tishomingo County. Outcrop near Banks of Bear River.

The Structural Materials of Mississippi

The structural materials of Mississippi consist of limestone for building purposes, for the manufacture of lime and cement, and for road metal; sandstones and ironstones for building purposes and for road metal; cherts, sand and gravel, for concrete and road metal; clays for Portland cement, terra cotta and brick; and sand for glass manufacture, ceramic and molding purposes.

BUILDING STONES.

The rocks of the State containing stone suitable for building purposes, are confined to a few formations and to limited areas. The oldest formations of the State, the Devonian and the Sub-Carboniferous, contain the most promising materials for building purposes. Less promising sources are the Ripley, the Clayton, the Tallahatta buhrstone, the Vicksburg and the Grand Gulf formations. Very limited quantities of building stones have been obtained from the Selma, the Wilcox and the Lafayette.

LIMESTONES.

Limestones suitable for structural purposes may be obtained in sufficient quantity, and of good quality, from the Devonian and from the Sub-Carboniferous formations which outcrop in Tishomingo County. More limited quantities of good stone have been found in the Selma, the Ripley, the Clayton and the Vicksburg formations.

Devonian Limestone.—The Devonian formation occupies a very limited areal extent in Tishomingo County. The formation consists of shales and limestones. Representative outcrops of these rocks are found along Yellow Creek, a tributary of the Tennessee River. The limestones attain a thickness of forty feet or more, and consist of layers of dark, compact, non-fossiliferous rock. The individual layers attain a thickness of eight feet or

more and are intersected by joint planes, which facilitate quarrying. For a fuller discussion of this, and the succeeding stones, see under the head of "Details by Counties."

Sub-Carboniferous Limestone.—The Sub-Carboniferous formation which overlies the Devonian formation in Tishomingo and in Itawamba County contains beds of limestone suitable for building purposes. The best outcrops occur along the course of Bear River. The limestone is gray in color and consists of compact layers, some of which attain a thickness of ten feet or more. These layers are intersected by joint planes and under the influence of weathering, they break up into large quadrangular blocks. These limestones have been used only to a very limited extent and for purely local purposes.

The Selma Limestone.—The Selma chalk or limestone contains, in very local areas, hard layers of limestone which has served a local demand for building material. Some of the layers are crinoidal, being composed largely of the cemented fragments of crinoid stems. Such resistant layers of the Selma chalk have been found in Noxubee, in Oktibbeha, and in Lee County, and further details are given under those headings.

Ripley Limestone.—The Ripley formation consists chiefly of marls, but contains some layers of fossiliferous limestone, which have been used locally for building purposes. The total thickness of the formation is about 300 feet. It occupies a very narrow belt of outcrop, extending along the western border of the Selma chalk from Houston to beyond the Tennessee line. The harder layers are confined to the eastern border.

Midway (Clayton) Limestone.—The lowermost member of the Eocene group of rocks in Mississippi is the Midway, which consists of two formations, the Clayton and the Porter's Creek or Flatwoods. The Clayton is a marine formation, consisting of fossiliferous limestones and sandstones. The Porter's Creek consists of clay which is non-fossiliferous and probably non-marine. The Porter's Creek outcrop extends along the western border of the Cretaceous outcrop, but the Clayton is not co-

extensive. It outcrops in the southern part of the area, and again in the northern, but no outcrops have been found between Houston and Shuqualak. Overlying the Ripley marl in the northern part of the area, there is a bed of limestone called the *Turritella* limestone, from the abundance in it of the fossil, *Turritella Mortoni*. This limestone outcrops in many small areas in Tippah and in Union County. It has served a local purpose for the construction of flues and the foundations for frame buildings.

Vicksburg Limestone.—The outcrop of the Vicksburg limestone extends across the State from Vicksburg to Waynesboro. The continuity of the outcrop is broken by the overlapping of younger formations and by the erosion of streams. As a rule the limestone is a soft, chalk-like rock of white color. In some exposures, however, the formation consists of layers of a moderately hard blue limestone, separated by about equal thickness of shell marl. The limestone has been used in practically all parts of the area of outcrop for local building purposes. Larger quantities of the harder stone have been shipped to distant points to be used for riprapping and other purposes.

SANDSTONES.

Sandstones occur in the Sub-Carboniferous, the Selma, the Clayton, the Tallahatta buhrstone, and the Grand Gulf. The best building stones are found in the sandstones of the Sub-Carboniferous and less suitable ones in the Tallahatta buhrstone and the Grand Gulf.

Sub-Carboniferous Sandstone.—The surface exposure of this sandstone is confined to Tishomingo, Prentiss and Itawamba Counties. The best exposures occur on Bear River, in Tishomingo County, where the beds attain a thickness of over 100 feet. The individual layers of the sandstone vary in thickness from a few inches to as much as ten feet. The layers are intersected by joint planes which, in some outcrops, divide the stone into huge blocks, some of which are as much as 10 feet thick, 12 feet wide, and 40 feet long. The stone is gray in color and for the



PLATE II.—Face of a Sandstone Outcrop on Bear River
in Tishomingo County.

most part free from discoloring substances. It is said to be soft and easily cut when first taken from the quarry, but to harden under exposure. It has been used for building purposes in the construction of houses, foundations, pavements, well curbs and chimneys. Some of the chimneys were constructed more than a half a century ago and are still in good condition.

Selma Sandstone.—The upper portion of the Selma chalk, merging into this Ripley marls, contains in certain localities considerable sand. These sandy phases of the Selma are, in some places, cemented, forming thin beds of sandstone, which are sufficiently indurated to be of use for local structural purposes. The quantity, however, is exceedingly limited, and this cannot be looked upon as a fruitful source of building material. Outcrops occur in Kemper, Noxubee and Oktibbeha Counties.

Clayton Sandstone.—The lower portion of the Clayton formation is composed of limestone, but the upper portion is a sand or sandy marl. The sand has, in some places, been changed into sandstone by cementation. The sandstone is rarely sufficiently indurated or the layers of sufficient thickness to be used for structural purposes.

Tallahatta Sandstone.—The Silicious Claiborne or Tallahatta buhrstone contains beds of a quartzitic sandstone which, in some localities, has been changed by metamorphism to a nearly pure quartzite, which reveals little of its arenaceous origin. The Tallahatta formation outcrops in a belt varying in width in its eastern border from 10 miles to 30 miles in its western border, and extending from Clarke County to Grenada County, where its outcrop becomes concealed by the alluvium of the Yazoo basin. The best exposures of the sandstone are found in Holmes, Attala, and Lauderdale Counties.

Grand Gulf Sandstone.—The Grand Gulf formation consists of sands, clays, gravels, sandstones and quartzites. The sandstones and quartzites are confined to the north-western part of the area of outcrop west of the Pearl River. Some of the stones are soft, fine-grained, aluminous rocks. Others are coarse-grained, incoherently ce-

mented rocks. Some, however, are hard, vitreous rocks of a quartzitic nature. The sandstone used in the old capitol building at Jackson was obtained from a quarry in the Grand Gulf near Raymond.

SAND.

Sand is being used in Mississippi in the manufacture of mortar, concrete and sand-lime brick, for sand-clay roads and for molding purposes. Good sands are available for nearly all of these purposes. The principal geological formations of the State, which are sand bearing, are the Tuscaloosa, Eutaw and Ripley of the Cretaceous, the Wilcox and Tallahatta buhrstone of the Eocene and the Grand Gulf and the Lafayette of the later Tertiary. There are other formations from which sand is derived by erosion, such as from sandy phases of the Selma, the Lisbon, the Jackson, and the Loess.

Building Sand.—The wide-spread distribution of the Lafayette has placed building sand within reach of nearly all communities in the State. In some localities, banks of clean sand occur in the formation and may be used directly from the mine without washing. In nearly all localities where the Lafayette has not been completely removed by erosion, beds of sand, suitable for building purposes, are to be found along the courses of streams and on their flood plains. Sharp sands are more abundant in the primary deposits of Lafayette. The secondary deposits of the streams are more water-worn, less sharp, and contain more clay. There is considerable variation in the size and composition of the sands of the State. Quartz is the predominant mineral, but in some localities the presence of considerable quantities of mica, glauconite, tourmaline or more rarely, magnetite may be detected.

Glass Sand.—There are beds of white sand in the Wilcox, the Tallahatta buhrstone and the Lafayette formations which are suitable for use in the manufacture of glass. Along the middle and lower courses of the Pearl River, there are beds of white sand which would doubtless serve a similar purpose. One of these localities

is at Byram, south of Jackson, and another is west of Millard on Bolo Creek in Pearl River County. Banks of white sand of good quality also occur in the Port Hudson sands of the Gulf Coast. In Tishomingo County there is a bed of finely divided silica which can be used in the manufacture of glass, as the analysis of the rock shows that it is 97 per cent pure silica.

Molding Sand.—Sand containing a small amount of clay is used in iron foundries for the purpose of making molds to receive the molten metal. Sand used for this purpose should be nearly free from iron and lime and should contain sufficient clay to make the grains adhere, but not enough to cause the mass to bake. The grain of the sand should be fine. A number of the geological formations of the State contain sands suitable for molding purposes. Among the more important of these formations are the Eutaw, the Wilcox, the Lafayette and the Columbia. A foundry at Corinth has given the yellow loam (Columbia) of that region a sufficient trial and have found it excellent for molding purposes. The foundrymen report that it may be used continuously if enough new sand is added occasionally to replace that lost by dehydration and scattering. In other words, that the whole mass never becomes dead. The Lafayette sands from two localities in Okitebbehah County have been tested in the college foundry and found satisfactory for molding purposes.

IRONSTONE.

The Wilcox and the Lafayette formations contain layers of ironstone which have been used locally for structural purposes. Towards the eastern part of the Wilcox area the ironstones are fossiliferous and irregularly bedded. In the central portion of the outcrop near Ackerman, they are non-fossiliferous, of more uniform thickness and more regularly bedded. The Lafayette beds are usually very irregular, and in many places fragmental. In some places the iron oxide has formed a cement for the gravel in the

deposit and the conglomerates thus formed, as well as the purer layers of ironstone, have served a local use for the building of chimneys, foundations and the curbing of wells.

CHERT.

The Sub-Carboniferous formation of Tishomingo County contains thick beds of silicious stone or chert. The thickness of the beds is at least 200 feet and probably 300



PLATE III.—A View of an Outcrop of Tuscaloosa Gravel in Tishomingo County. Upper Portion Probably Lafayette.

feet. The cherts lie in thin layers, which break up on weathering, into triangular and quadrangular blocks of small size. This chert can be used to great advantage as concrete material and as road metal.

GRAVEL.

Beds of gravel occur in Mississippi in the Tuscaloosa, the Grand Gulf and the Lafayette formations. The

Tuscaloosa gravels are confined to a few counties in the northeastern part of the State, the principal deposits occurring in Tishomingo and in Itawamba. The Tuscaloosa gravels are composed of opaque white chert and contain a large percentage of big sub-angular pebbles, the largest of which have a diameter of seven inches. Judging from their slightly worn condition, they have not been transported great distances, and they may have been derived from the Sub-Carboniferous cherts, which in some instances, underlie them.

The Grand Gulf gravels occupy a belt extending across the State from Natchez to Hattiesburg. The gravels, as a rule, are not as coarse as those in the Tuscaloosa, but those at Natchez are about the same size in the lower portion of the deposit, but much more water-worn. They are composed of white and yellow opaque cherts, milk-white and transparent quartz and crystallines. The voids of the gravel are usually filled with clean sand. From the standpoint of quality, quantity and ease of working, these are among the most promising gravel deposits in the State.

The Lafayette gravels are usually well worn and occur usually in thin beds. The beds attain their greatest thickness along the courses of the larger streams. The gravels are composed of white, yellow and black cherts and white and transparent quartz. Some of the cherts contain the impressions of marine forms. The Lafayette gravels are much more widely distributed than the others.

ROAD METAL.

The road materials of the State consist of cherts, gravels, limestones, ironstone, asphaltic sandstone, quartzites, clays for burnt ballast, and clay and sand for sand-clay roads. Because of the untested and undeveloped condition of much of this metal, large quantities of road metal are being shipped into the State. The best limestones for road metal occur in the Devonian and Sub-Carboniferous strata. The latter also contains an as-



PLATE IVa.—The Gulf Coast, Showing the White Coastal Sands.

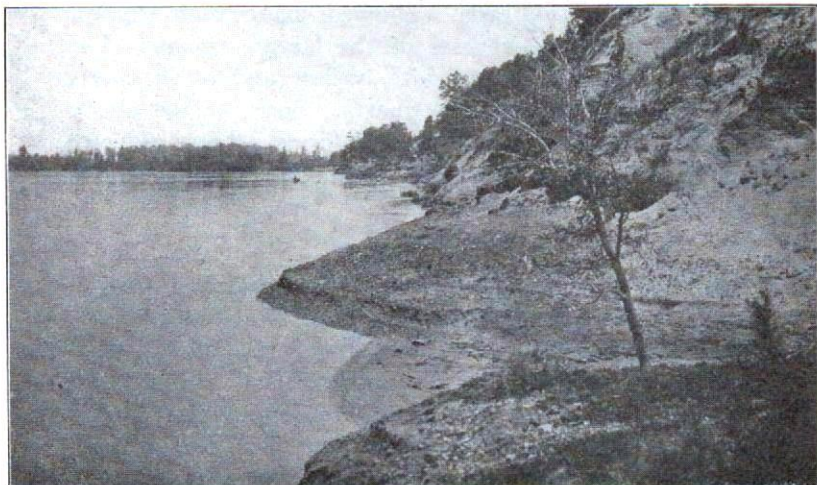


PLATE IVb.—Gravel Point on the Mississippi River at Natchez.

phaltic sandstone which, when crushed, would probably make a serviceable top dressing. Thick beds of chert are also found in this formation. The Tallahatta buhrstone contains hard, flinty quartzitic rocks, which are serviceable for road metal. The Wilcox and the Lafayette each contain layers of ironstone. The Tuscaloosa, the Grand Gulf and the Lafayette contain beds of gravel. The Selma, the Yazoo alluvium, the Flatwoods and other formations contain clays suitable for burnt ballast. The oyster beds of the Gulf yield shells which are used for surfacing the roads in that locality. A fuller discussion of these various road metals will be found under the different counties.

LIME.

The formations of the State which may be looked to as the sources of lime are the Devonian, the Sub-Carboniferous, the Selma, the Ripley, the Clayton and the Vicksburg. The Devonian limestones have not, to my knowledge, been used for the manufacture of lime. The Sub-Carboniferous limestone from Cypress Pond in Tishomingo County has been burned successfully. The Selma chalk has been used in only a very limited way. The large plecy pod shells occurring very abundantly in some horizons of the formation have been burned for lime. There are localities where the chalk is composed of more than ninety per cent of calcium carbonate and would be very suitable for the manufacture of lime. The Ripley limestone near Ellistown, in Union County, has been burned to serve a local demand for lime. The Clayton limestone is sufficiently pure in some localities to be used for this purpose. The Vicksburg limestone has been utilized for the manufacture of lime in a number of counties.

CEMENT.

The geological formations of Mississippi contain rocks suitable for the manufacture of Portland cement and probably natural cements. Speaking of the latter,



PLATE V.—A Large Sandstone Block from the Sub-Carboniferous of Bear River, in Tishomingo County.

Dr. Hilgard, in his report on the Geology and Agriculture of Mississippi, says: "These analyses, as well as the experiments made, leave no doubt as to the adaptness of these rocks to the manufacture of excellent hydraulic cements." These words were spoken of the Devonian rocks in Tishomingo County. The most promising material for the manufacture of Portland cement is to be found in the Devonian, the Sub-Carboniferous, the Selma, the Jackson, and the Vicksburg formations of the State. The clays, shales and limestones of these formations can be utilized to good advantage in the manufacture of Portland cement. For a more complete discussion of the subject, see Bulletin No. 1 of the Mississippi Geological Survey Reports.

BRICK AND TERRA COTTA CLAYS.

Common brick clays are found in nearly all parts of the State. The brown and yellow loams of the Columbia are more widely used because of their widespread distribution. The clays from the Yazoo basin alluvium, the Lafayette, the residual Selma, and the residual clays from other formations are also used. Front brick are manufactured from the Wilcox, the Grand Gulf and the brown loam. The Tuscaloosa and the Wilcox clays have been used in the manufacture of fire brick. The latter has also been used in the manufacture of Terra Cotta. A complete discussion of the distribution properties and uses of the clays of the State is contained in Bulletins Nos. 2, 4 and 6 of the Mississippi State Geological Survey Reports.

The Structural Materials of Mississippi by Counties

The following pages contain a statement of our present knowledge of the more valuable structural materials to be found in some of the important localities of the State. Not all of the counties containing structural materials are mentioned, but only a few from each important geological division.

ADAMS COUNTY.

The rocks of the Grand Gulf formation constitute the geological sub-structure of Adams County. These rocks are concealed in a large measure by the sands and gravels of the Lafayette and the silt of the loess. The structural materials of the county are sands, gravels and brick clays. The first two are obtained from the Grand Gulf and the Lafayette and the last from the loess, the Columbia and the river alluvium.

Natchez Sand and Gravel Deposits.—At Gravel Point, on the east bank of the Mississippi River, one mile north of the Y. and M. V. station in Natchez, there is exposed a thick bed of sand and gravel. In 1908, the writer published, in Bulletin 4 of the Survey Reports, the following description of this exposure:

Section at Gravel Point, North of Natchez.

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 feet.
4. Reddish, sandy clay, coarse and gritty to the touch, apparently a residual product from a clayey sand..... 25 to 40 feet.
3. Sands with gravel, tumultuously cross-bedded..... 100 to 150 feet.
2. Coarse gravel and pebbles (boulders), yellow cherts predominating, some crystalline; many pebbles as large as 5 inches in diameter, some cemented by limonite into pudding stone; layer exposed for 10 or 15 yards along the river bank..... 8 to 10 feet.
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. 61 feet.

The observations recorded above were made in the year 1907. On visiting the outcrop in 1911, the writer found that the river had cut against the bank and exposed

a greater thickness of layers 1 and 2, there being exposed now as much as 15 feet of the former and 25 feet of the latter.

The gravels and sands contained in layers 1 and 2 of the above section may be looked upon as the source of a good quality of material for concrete and other purposes.

TABLE 1.

Granulometric Analysis of Grave' from No. 1.

1. Amount retained on 1½-inch mesh sieve.....	20%	passed 80%
2. Amount retained on 1 -inch mesh sieve.....	50%	passed 30%
3. Amount retained on ¾-inch mesh sieve.....	28%	passed 2%

The percentage of voids in this sample is .30; the weight per cubic foot is 117 pounds and the specific gravity 1.88. The percentage of voids in a second sample is .36; the weight per cubic foot is 110 pounds and the specific gravity is 1.77.

Layer No. 3 of the section contains much more sand than gravel, in fact, in places, layers of pure sand occur. A sample of the sand taken from one of these layers contained only one per cent, which would not pass a 16-inch mesh sieve. The following is a granulometric analysis of a sample of the sand from layer No. 3.

TABLE 2.

Granulometric Analysis of Sand from No. 3.

1. Amount retained on 16-mesh sieve.....	1%	passed 99%
2. Amount retained on 20-mesh sieve.....	1%	passed 98%
3. Amount retained on 40-mesh sieve.....	18%	passed 80%
4. Amount retained on 60-mesh sieve.....	68%	passed 12%
5. Amount retained on 80-mesh sieve.....	11%	passed 1%
6. Amount retained on 100-mesh sieve.....	00%	passed 1%

The percentage of voids is .39; the weight per cubic foot 92 pounds; the specific gravity is 1.48. Tensile strength of 1 to 3 cement mixture at the end of 90 days, 300 pounds.

ATTALA COUNTY.

The Wilcox and the Tallahatta buhrstone of the Eocene period form the bed-rock formations of Attala County.

The surficial formations belong to the Lafayette and the Columbia. The Wilcox contains brick and pottery clays and building sands. The Tallahatta contains quartzitic sandstones and building sands. The Lafayette deposits contain building sands and the Columbia brick clays.

Attala Sandstone.—The Tallahatta buhrstone of Attala County contains a quartzitic sandstone, which has been used locally for building purposes. Outcrops of this rock occur at Kosciusko. In a cut made by a wagon road in the south part of town, the following section is exposed:

Section at Kosciusko.

3. Brown loam (Columbia) top of hill.....	4 feet.
2. Red to orange colored sand (Lafayette).....	20 feet.
1. White, soft to quartzitic sandstone (Tallahatta).....	31 feet.

Exposures of this stone occur also one mile south of Kosciusko and five miles north. The latter outcrop contains an upper layer of soft sandstone, having a thickness of about 10 feet, and a lower layer of quartzitic rock, having a thickness of from 15 to 18 feet. The two layers are separated by layers of sand and sandy clay.

Across the Big Black River from West, there is an outcrop of the Tallahatta quartzitic rock. The maximum thickness of the exposure is 18 feet, but the average thickness is only about 6 feet. A few years ago a quarry was opened at this point and over 100 cars of rock were shipped to a point in Louisiana, to be used in road construction. The expense of crushing this rock is exceeding high, as it is not easily broken by explosives.

Building Sand near Ethel.—The hills north of Ethel are composed of the sands and the clays of the Wilcox formation and capped with Tallahatta buhrstone. Beds of white and yellow sands are found along the hill sides and in the creek valleys. These sands have been used in Ethel for common plaster and brick mortar. The mechanical condition of a sample of the sand is exhibited in the following table:

TABLE 3.

Granularmetric Analysis of Ethel Sand.

1. Amount retained on 16-mesh sieve.....	00.0%	passed	100.0%
2. Amount retained on 20-mesh sieve.....	.8%	passed	99.2%
3. Amount retained on 40-mesh sieve.....	20.1%	passed	79.1%
4. Amount retained on 60-mesh sieve.....	36.9%	passed	42.2%
5. Amount retained on 80-mesh sieve.....	33.5%	passed	8.7%
6. Amount retained on 100-mesh sieve.....	2.8%	passed	5.9%

The percentage of voids in a sample of the sand is 38; the weight per cubic foot is 88 pounds; the specific gravity is 1.42. The average tensile strength of a mixture of three parts sand to one part cement was:

No. 1 Briquette.....	280 pounds.
No. 2 Briquette.....	335 pounds.
No. 3 Briquette.....	281 pounds.
Average.....	298.6 pounds.

CHICKASAW COUNTY.

The Selma chalk and the Ripley marls occupy the sub-surface of Chickasaw County, east of Houston. The Clayton and the Porter's creek formations occupy the sub-surface of the western portion of the county. These bed-rock formations are partly concealed by the sands and clays of the Lafayette and the loams of the Columbia. The structural materials of the county consist of sands, clays, sandstones and limestones.

Clayton Limestone.—The Clayton limestone outcrops at several points between Pontotoc and Houston. It is exposed for 100 yards in a small creek bed, about one mile and a half north of Houston, on the west side of the railroad. The surface of the limestone is rough and shows the signs of much weathering. The color varies from gray to yellow. The total thickness of the bed is about 10 feet. The individual layers vary from 6 to 18 inches in thickness. This limestone occurs, also capping a low ridge on the east side of the railroad, one mile north of Houston. A sample of this limestone has an absorption of 10.2 per cent.

Other exposures of the limestone are found along the M. J. and K. C. R. R., between Houston and Pontotoc. There are outcrops of a crumbly white limestone in rail-

road cuts near Algoma. Near Gershorn the exposures are 10 feet in thickness. It is exposed in a stream bed south of New Houlika, and south of Belmont there are exposures in the railroad cuts and stream channels. Some of the individual layers are 18 inches in thickness and fairly resistant.

COPIAH COUNTY.

The structural materials of Copiah County are found in the strata of the Grand Gulf, the Lafayette and the Columbia. The first two contain sand and gravel, and the last brick clays. Very important deposits of gravel occur in this county.

Crystal Springs Gravel.—Numerous outcrops of gravel and sand are found around Crystal Springs and much gravelly soil occurs on the slopes of the ridges. Well records indicate that from 50 to 70 feet of sand and gravel exist in some of these deposits. The gravels are chiefly water-worn pebbles, consisting for the most part, of yellow or white cherts. In size, the pebbles vary from a pea to 3 inches in diameter. The sample below was taken from a cultivated field just south of town.

TABLE 4.

Granularmetric Analysis of Crystal Springs Gravel.

1. Amount retained on 1½-inch mesh sieve.....	5%, passed 95%
2. Amount retained on 1 -inch mesh sieve.....	51%, passed 44%
3. Amount retained on ½-inch mesh sieve.....	34%, passed 10%

These beds can be profitably washed for concrete material, especially when they are situated near a permanent water supply and not too deeply covered with over-burden.

Wesson.—Gravel occurs on the slopes and the crowns of the hills around Wesson and is pierced by the wells of that locality. The quality is very similar to that described above; the degree of fineness is given below.

TABLE 5.

Granularmetric Analysis of Wesson Gravel.

1. Amount retained on 1½-inch mesh sieve.....	1%, passed 99%
2. Amount retained on 1 -inch mesh sieve.....	32%, passed 67%
3. Amount retained on ½-inch mesh sieve.....	51%, passed 16%

The percentage of voids contained in this sample is 39; the weight per cubic foot is 101.6 pounds.



PLATE VIa.—Screen of the Louisiana Sand and Gravel Company, near Hattiesburg



PLATE VIb.—General View of the Louisiana Sand and Gravel Company's Plant, Hattiesburg.

FORREST COUNTY.

Forrest County contains no structural material of note except sands, gravels and brick clays. The former are derived from the Grand Gulf and the Lafayette and the latter from the Columbia loams and residual clays of the older formations.

Hattiesburg Gravel.—The pit of the Louisiana Sand and Gravel Co. is located above Hattiesburg on the Leaf River. The upper part of the pit is above the water level and contains about eighteen feet of gravel. This portion is worked by steam shovel. The gravel below the water level is said to have been worked to a depth of thirty feet, a steam dredge being employed in this portion of the pit. The plant is supplied with a complete washing outfit and furnishes both run of pit and washed gravel. Of a sample taken from the dredged portion of the pit, about 51% was retained on a 16-inch mesh screen. The degree of fineness of the sand passing through the sieve is given below.

TABLE NO. 6.

Granularmetric Analysis of Hattiesburg Sand.

1. Amount retained on 20-mesh sieve	24%, passed 76%
2. Amount retained on 40-mesh sieve	29%, passed 47%
3. Amount retained on 60-mesh sieve	32%, passed 15%
4. Amount retained on 80-mesh sieve	12%, passed 3%
5. Amount retained on 100-mesh sieve	00%, passed 3%

The sand, which was river washed, and which has been used by the company, is a grayish-white sand and exhibits the following degree of fineness:

TABLE NO. 7.

Granularmetric Analysis of Hattiesburg River Sand.

1. Amount retained on 16-mesh sieve	28%, passed 72%
2. Amount retained on 20-mesh sieve	20%, passed 52%
3. Amount retained on 40-mesh sieve	38%, passed 1.4%
4. Amount retained on 60-mesh sieve	11%, passed 3%
5. Amount retained on 80-mesh sieve	3%, passed 00%
6. Amount retained on 100-mesh sieve	00%, passed 00%

The percentage of voids is thirty; the weight per cubic foot is 112 pounds; the specific gravity is 1.79.

This is a clean sand, free from clay. A sample of the sand which had been separated from the gravel in the screening process at the pit exhibited the following degree of fineness:

TABLE NO. 8

Granularmetric Analysis of Hattiesburg Sand from Pit.

1. Amount retained on 16-mesh sieve.....	47%	passed 53%
2. Amount retained on 20-mesh sieve.....	21%	passed 32%
3. Amount retained on 40-mesh sieve.....	23%	passed 9%
4. Amount retained on 60-mesh sieve.....	6%	passed 3%
5. Amount retained on 80-mesh sieve.....	2%	passed 1%

The percentage of voids is 32; the weight per cubic foot is 112 pounds; the specific gravity is 1.80. The tensile strength of a 1 to 3 mixture of standard cement after 90 days was 320.6 pounds.

TABLE NO. 9.

Granularmetric Analysis of Lower Gravel, Hattiesburg.

1. Amount retained on 1½-inch mesh sieve.....	1%	passed 99%
2. Amount retained on 1 -inch mesh sieve.....	3%	passed 96%
3. Amount retained on ½-inch mesh sieve.....	29%	passed 67%

The sample taken from the portion above the water level, or dredged horizon, contained about 40% of sand. The size of the gravel is as follows:

TABLE NO. 10.

Granularmetric Analysis of Upper Gravel, Hattiesburg.

1. Amount retained on 1½-inch mesh sieve.....	1%	passed 99%
2. Amount retained on 1 -inch mesh sieve.....	8%	passed 91%
3. Amount retained on ½-inch mesh sieve.....	11%	passed 80%

The percentage of voids is 38; the weight per cubic foot is 105.32 pounds. The sand taken from this sample showed the following degree of fineness:

TABLE NO. 11.

Granularmetric Analysis of Upper Sand, Hattiesburg.

1. Amount retained on 20-mesh sieve.....	16%, passed 84%
2. Amount retained on 40-mesh sieve.....	65%, passed 19%
3. Amount retained on 60-mesh sieve.....	17%, passed 2%
4. Amount retained on 80-mesh sieve.....	2%, passed 00%
5. Amount retained on 100-mesh sieve.....	00%, passed 00%

GEORGE COUNTY.

The Grand Gulf and Lafayette formations of George County contain sands and gravels which can be used for structural purposes. The amount of gravel, however, is probably small.

Lucedale Sand.—Deposits of sand occur in the immediate vicinity of Lucedale in superficial formations of probably Lafayette age. Thicknesses of sand of fifteen feet are exposed in railroad cuts near the town. This sand is used locally for structural purposes. A sample of sand which was used in the construction of the County Court House exhibited the following degree of fineness:

TABLE NO. 12.

Granularmetric Analysis of Sand, Lucedale.

1. Amount retained on 16-mesh sieve.....	1%, passed 99%
2. Amount retained on 20-mesh sieve.....	3%, passed 96%
3. Amount retained on 40-mesh sieve.....	61%, passed 35%
4. Amount retained on 60-mesh sieve.....	25%, passed 10%
5. Amount retained on 80-mesh sieve.....	7%, passed 3%
6. Amount retained on 100-mesh sieve.....	0%, passed 3%

The percentage of voids is 40; the weight per cubic foot is 88 pounds; the specific gravity is 1.42. The tensile strength of a 1 to 3 mixture of standard cement, after 90 days, was 215 pounds per square inch.

GRENADA COUNTY.

The sands of Grenada County are derived from the Wilcox and the Lafayette, and the gravels from the latter. The white sands from the Yalobusha River at Grenada

have been used in the manufacture of sand-lime brick. The sand is a gray sand of fine grain. The white clays of the Wilcox have been used to a limited extent in the manufacture of brick. The most abundant brick material is from the Columbia loam.

HARRISON COUNTY.

The structural material of Harrison County are confined to the sands of the Lafayette and the Port Hudson, the gravel of the Lafayette and the residual clays of the surficial formations. The sands can be used for mortar, concrete, sand-lime, brick, sand-clay roads and in the manufacture of glass.

Wiggins Sand.—Deposits of white or gray sand are common along the beds of creeks which have their channels through the Lafayette formation in the vicinity of Wiggins. A sample of sand was taken for examination from a creek bed about six miles east of Wiggins.

TABLE NO. 13.

Granularmetric Analysis of Wiggins Sand.

1. Amount retained on 16-mesh sieve00%, passed 100%
2. Amount retained on 20-mesh sieve	1%, passed 99%
3. Amount retained on 40-mesh sieve	26%, passed 73%
4. Amount retained on 60-mesh sieve	61%, passed 12%
5. Amount retained on 80-mesh sieve	10%, passed 2%
6. Amount retained on 100-mesh sieve	1%, passed 1%

The percentage of voids is 39; the weight per cubic foot is 99 pounds; the specific gravity is 1.59. The tensile strength of a 1 to 3 mixture of standard cement is 211.6 pounds (average for 3 samples).

Saucier Sand.—A ridge of sand and sandy loam lies about one mile south of the G. & S. I. Railroad station at Saucier. The base of the sand contains a little fine gravel, which is cemented together by iron oxide in some places. The deposits rest on the surface of the Grand Gulf clays.

TABLE NO. 14.

Granularmetric Analysis of Saucier Sand.

1.	Amount retained on 16-mesh sieve.....	2%,	passed	98%
2.	Amount retained on 20-mesh sieve.....	1%,	passed	97%
3.	Amount retained on 40-mesh sieve.....	28%,	passed	69%
4.	Amount retained on 60-mesh sieve.....	54%,	passed	15%
5.	Amount retained on 80-mesh sieve.....	12%,	passed	3%
6.	Amount retained on 100-mesh sieve.....	1%,	passed	2%

Granularmetric Analysis of Saucier Sand, Sample No. 2.

1.	Amount retained on 16-mesh sieve.....	1%,	passed	99%
2.	Amount retained on 20-mesh sieve.....	1%,	passed	98%
3.	Amount retained on 40-mesh sieve.....	28%,	passed	70%
4.	Amount retained on 60-mesh sieve.....	54%,	passed	16%
5.	Amount retained on 80-mesh sieve.....	13%,	passed	3%
6.	Amount retained on 100-mesh sieve.....	1%,	passed	2%

The percentage of voids is 37; the weight per cubic foot is 97 pounds; the specific gravity is 1.56. The average tensile strength of 3 samples of a 1 to 3 mixture of standard cement is 235 pounds.

HOLMES COUNTY.

The only source of building stone in Holmes County is the Tallahatta Buhrstone, which outcrops in the western part of the county. The Lafayette formation contains sands and gravels, while the brown loam furnishes brick clay.

West Quartzitic Sandstone.—The quartzitic layer of the buhrstone is exposed at West in Holmes County. Outcrops occur on both sides of the Big Black River. The outcrop on the west side of the river extends in a northwesterly direction for at least three miles, but it is not continuous for this distance. The maximum thickness is about eighteen feet, but the average is not over six feet. In places the sandstone has a heavy overburden of clay or loam. The outcrops rarely form continuous ledges, but are more frequently isolated masses or boulders. The sandstones are friable, but the quartzitic masses are hard and difficult to break up even with ex-



PLATE VIIa.—Outcrop of Vicksburg Limestone near Brandon.



PLATE VIIb.—An Exposure of Tallahatta Buhrstone near West, in Holmes County.

plosives. This material has been used for road metal. A few years ago about one hundred carloads were shipped to Louisiana to be used for that purpose. This quartzite shows no absorption.

JASPER COUNTY.

The structural materials of Jasper County are derived from the Jackson, the Vicksburg, the Grand Gulf, and the Lafayette. They consist of sands, gravels and limestones.

Barnett Sand.—On the L. O. Stevenson farm, near Barnett, there is a ridge of Lafayette sand and gravel, the gravel occurring largely at the base of the ridge. The gravels are not of large size. The sand is free from clay and other impurities and is of serviceable quality.

TABLE NO. 15.

Granularmetric Analysis of Stevenson Sand, No. 1.

1. Amount retained on 16-mesh sieve.....	22%, passed	78%
2. Amount retained on 20-mesh sieve.....	6%, passed	72%
3. Amount retained on 40-mesh sieve.....	21%, passed	51%
4. Amount retained on 60-mesh sieve.....	22%, passed	29%
5. Amount retained on 80-mesh sieve.....	18%, passed	11%
6. Amount retained on 100-mesh sieve.....	00%, passed	11%

Granularmetric Analysis of Stevenson Sand, No. 2.

1. Amount retained on 16-mesh sieve.....	17%, passed	83%
2. Amount retained on 20-mesh sieve.....	5%, passed	78%
3. Amount retained on 40-mesh sieve.....	20%, passed	58%
4. Amount retained on 60-mesh sieve.....	21%, passed	37%
5. Amount retained on 80-mesh sieve.....	20%, passed	17%
6. Amount retained on 100-mesh sieve.....	6%, passed	11%

The percentage of voids is 32; the weight per cubic foot is 100 pounds; the specific gravity is 1.76. The tensile strength of a 1 to 3 mixture of standard cement is 185 pounds after 90 days set.

Vosburg Sand.—At the station on the N. O. & N. E. railroad, at Vosburg, the railroad cuts through a ridge of sand and gravel. The following section is exposed at this point:

- | | |
|--|---------|
| 4. Orange colored sand containing small gravel and lenticular masses
of clay 20 feet, increasing toward crest of ridge..... | 30 feet |
| 3. Thin white soapy-like rock with shell impressions..... | 2 feet |
| 2. Yellow ochre..... | 1 foot |
| 1. Sand, yellow..... | 1 foot |

A sample of the sand taken from the Lafayette exposure has the following degree of fineness:

TABLE NO. 16.

Granularmetric Analysis of Vosburg Sand.

1. Amount retained on 16-mesh sieve.....	2%, passed	98%
2. Amount retained on 20-mesh sieve.....	2%, passed	96%
3. Amount retained on 40-mesh sieve.....	15%, passed	81%
4. Amount retained on 60-mesh sieve.....	60%, passed	21%
5. Amount retained on 80-mesh sieve.....	15%, passed	6%
6. Amount retained on 100-mesh sieve.....	1%, passed	5%

The percentage of voids is 41; the weight per cubic foot is 94 pounds; the specific gravity is 1.51.

Bay Springs Building Stone.—About 4 miles west of Bay Springs in Jasper County there are outcrops of stratified white and yellow sandstone. Below the layers of sandstone are beds of clay. Above are Lafayette gravels, sands and ironstone, having a thickness of 20 or 30 feet. The sandstone has an absorption of 13.2%. The sandstone is too porous and soft to be of much value as a structural material. On the east bank of Tallahala Creek, at the crossing of the public road, there is an exposure of Vicksburg limestone. The upper ledge consists of a hard, bluish-grey limestone, which is of value as a structural material. The lower portion consists of a soft, unindurated material (limestone) which is easily cut, but is of little resistance. The limestone from this vicinity is used locally for building purposes, and the burning of lime.

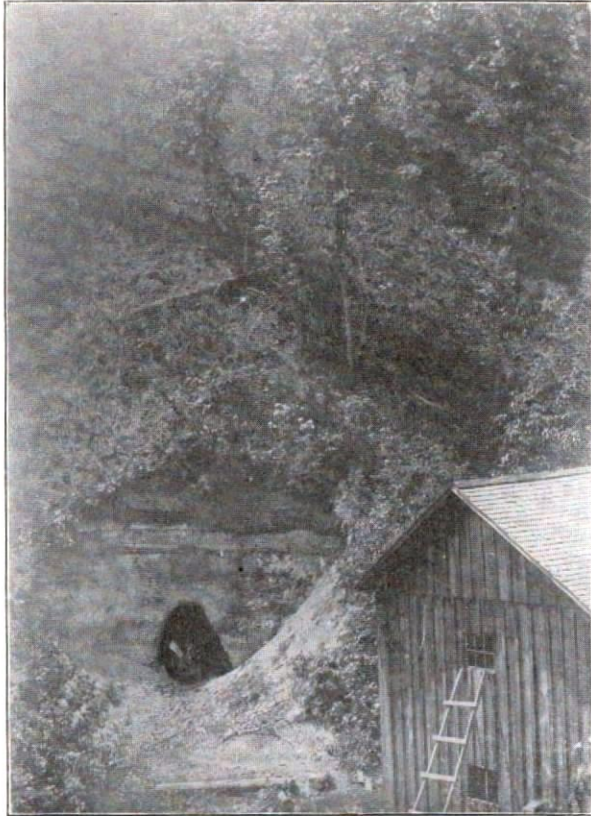


PLATE VIII.—A Silica Mine in Tishomingo County, Sub-Carboniferous Strata.

JEFFERSON DAVIS COUNTY.

Mount Olive Road.—The structural materials of this county are confined to the sands and gravels of the Lafayette. Some of the gravel deposits are very promising. A sample of gravel was collected from an outcrop 4 miles west of Mount Olive by Mr. E. S. Porter, who gives the following description of the occurrence:

“On a cut on the Mount Olive Road, 4 miles west of Mount Olive, from 4 to 6 feet of gravel is exposed; the lower limitation of the gravel is not exposed, good gravel being found at the lowest part of the cut. Some sand is also present, the gravel itself ranging in size from a pigeon’s or bantam’s egg to a hickory nut. No other excavation has been made in the deposits than the road cut, but from the fact that on either side of the road, gravel is found near the surface, it is probable that the low hill at this point is largely composed of gravel and sand similar to that exposed in the road cut.”

TABLE NO. 17.

Granularmetric Analysis of Mount Olive Sand.

1. Amount retained on 16-mesh sieve.....	00%	passed 100%
2. Amount retained on 20-mesh sieve.....	10%	passed 90%
3. Amount retained on 40-mesh sieve.....	47%	passed 43%
4. Amount retained on 60-mesh sieve.....	27%	passed 16%
5. Amount retained on 80-mesh sieve.....	12%	passed 4%
6. Amount retained on 100-mesh sieve.....	3%	passed 1%

The percentage of voids is about 30; weight per cubic foot is 110 pounds of all passing 16 mesh sieve.

A sample of the gravel possesses the characteristics given below:

TABLE NO. 18.

Granularmetric Analysis of Mount Olive Gravel.

1. Amount retained on 1½-mesh sieve.....	00%	passed 100%
2. Amount retained on 1 -mesh sieve.....	20%	passed 80%
3. Amount retained on ½-mesh sieve.....	30%	passed 50%

The percentage of voids is about 48; the weight per cubic foot is 117 pounds of all that was retained on a 16 mesh sieve.

JONES COUNTY.

Jones County lies wholly within the area which has the Grand Gulf as a substratum. Its structural materials consist of sands and gravels from the Grand Gulf and Lafayette and clays from the surficial formations.

Moselle Gravel.—A bed of gravel occurs on the Leaf River bottom about three miles south of Moselle on the Estabutachie Road. The thickness of the bed is not revealed, as only the upper surface is exposed. A little of the gravel has been removed for road purposes. The gravel contained about 30% of sand. A sample of the gravel graded as follows:

TABLE NO. 19.

Granulometric Analysis of Moselle Gravel.

1. Amount retained on 1 -inch mesh sieve.....	35%	passed	65%
2. Amount retained on ½-inch mesh sieve.....	36%	passed	29%

The percentage of voids is 39; the weight per cubic foot is 106 pounds.

The sand obtained from the gravel showed on examination the following degree of fineness:

TABLE NO. 20.

Granulometric Analysis of Moselle Sand, Sample No. 1.

1. Amount retained on 20-mesh sieve.....	13%	passed	87%
2. Amount retained on 40-mesh sieve.....	57%	passed	30%
3. Amount retained on 60-mesh sieve.....	19%	passed	11%
4. Amount retained on 80-mesh sieve.....	4%	passed	7%
5. Amount retained on 100-mesh sieve.....	1%	passed	6%

Granulometric Analysis of Moselle Sand, Sample No. 2.

1. Amount retained on 20-mesh sieve.....	23%	passed	77%
2. Amount retained on 40-mesh sieve.....	55%	passed	22%
3. Amount retained on 60-mesh sieve.....	19%	passed	4%
4. Amount retained on 80-mesh sieve.....	3%	passed	3%
5. Amount retained on 100-mesh sieve.....	1%	passed	%

The percentage of voids is 40; the weight per cubic foot is 116.5 pounds.

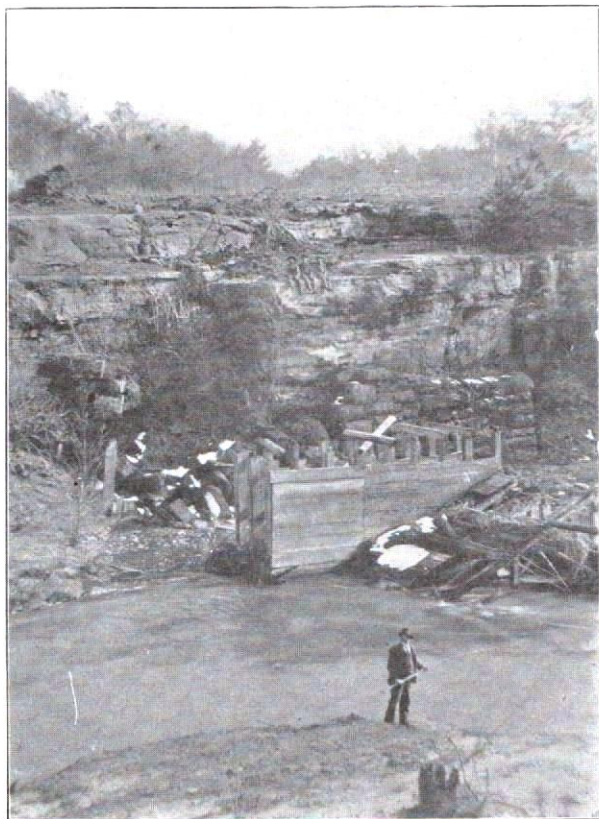


PLATE IX.—Sub-Carboniferous Sandstone on Mackey Creek near Bay Springs. Old Mill Site.

LAUDERDALE COUNTY.

The Tallahatta buhrstone formation, which extends across the State in a line parallel with a line passing from Meridian to Greenville, contains beds of sand suitable for building purposes, and also beds of sandstone of varying degrees of induration in different localities. This formation, together with the Wilcox and the Lafayette, contain the principal sources of structural material of Lauderdale County.

West of Meridian.—About four miles west of Meridian, there is a chain of hills which are capped with layers of a quartzitic sandstone and clay stone. An outcrop occurs on the Mehan Road, west of Meridian and contains the following:

1. Claystone and sandstone.....	25 feet
2. Clay, greenish in color.....	10 feet
3. White sand, crossbedded.....	15 feet

The claystone has a greenish tint, and is very friable. It is not suitable for structural purposes, as it breaks up readily into cuboidal and irregular blocks under the action of weathering. Its absorption is 19.8 per cent. The quartz rock occurs in thin layers, which are somewhat irregular in continuity, being pitted with pockets of sand or silicious clay. These layers outcrop in the bed of the Chunkey from Mehan Station to Wanita bridge. Ledges of rock occur on the border of the mill pond at Wanita. No quarries of this rock have been opened which contain stone suitable for building purposes, though it is possible such exist. Locally, some of the rock has been used in chimneys, and for underpinning for houses. As a road metal, it may be used to advantage, as it offers excellent resistance to wear, though the cost of crushing might be prohibitive. The quartzitic sandstone has an absorption of only 1.2 per cent.

On the banks of Okatibbee Creek, on the Mehan Road, there are banks of sand which have been used for building purposes in Meridian and for the purpose of building sand-clay roads in Lauderdale County. The sand

is a gray colored sand, composed almost altogether of rounded quartz grains. A mechanical analysis shows the sand to have the following state of fineness:

TABLE NO. 21.

Granularmetric Analysis of Okatibbee Creek Sand.

1. Amount retained on 16-mesh sieve.....	00%, passed 100%
2. Amount retained on 20-mesh sieve.....	1%, passed 99.9%
3. Amount retained on 40-mesh sieve.....	1.9%, passed 98%
4. Amount retained on 60-mesh sieve.....	60.2%, passed 37.8%
5. Amount retained on 80-mesh sieve.....	30.0%, passed 7.8%
6. Amount retained on 100-mesh sieve.....	1.5%, passed 6.3%

When mixed with 1-3 its weight of standard cement, and tested for tensile strength, the briquettes, after a setting of 3 and 90 days, gave results as follows:

	3 Days	90 Days
No. 1. Briquette.....	68 pounds	325 pounds
No. 2. Briquette.....	60 pounds	260 pounds
No. 3. Briquette.....	76 pounds	290 pounds
Average strength.....	68 pounds	291.6 pounds

The white sand mentioned in the above section is probably the origin of a large part of the sand found along Okatibbee, though some of it may be derived from the Lafayette, which forms a capping for the hills. The sand in the lowermost member of the section is a very clear, white sand. The following table shows the mechanical condition of the sand:

TABLE NO. 22.

Granularmetric Analysis of Claiborne Sand, Sample No. 1.

1. Amount retained on 16-mesh sieve.....	0%, passed 100 %
2. Amount retained on 20-mesh sieve.....	2%, passed 99.8%
3. Amount retained on 40-mesh sieve.....	22.5%, passed 77.3%
4. Amount retained on 60-mesh sieve.....	46.0%, passed 31.3%
5. Amount retained on 80-mesh sieve.....	27.0%, passed 4.3%
6. Amount retained on 100-mesh sieve.....	2%, passed 4.1%

Granularmetric Analysis of Claiborne Sand, Sample No. 2.

1. Amount retained on 16-mesh sieve.....	0.4%, passed 99.6%
2. Amount retained on 20-mesh sieve.....	5%, passed 99.1%
3. Amount retained on 40-mesh sieve.....	16.0%, passed 83.1%
4. Amount retained on 60-mesh sieve.....	45.8%, passed 37.3%
5. Amount retained on 80-mesh sieve.....	32.0%, passed 5.3%
6. Amount retained on 100-mesh sieve.....	1.6%, passed 3.7%

The percentage of voids is 44; the weight per cubic foot is 93 pounds; the specific gravity is 1.49. The test for tensile strength with 1-3 cement gave results as follows:

	3 Days	90 Days
No. 1. Briquette	57 pounds	295 pounds
No. 2. Briquette	44 pounds	300 pounds
No. 3. Briquette.....	52 pounds	290 pounds
Average tensile strength.....	51 pounds	295 pounds

Lauderdale Sand.—Deposits of sand are abundant in the Wilcox formation area east of Lauderdale. In the course of the old railroad from this point to York, Alabama, deep cuts were made in the Wilcox, revealing thick beds of purple, pink, red and yellow sands. Where these sands have been washed into creek beds, they are white or yellow in color, and the finer particles, such as thin grains of mica, have been removed.

TABLE NO. 23.

Granularmetric Analysis of Sand, Sample No. 1.

Old railroad cut, one mile east of Lauderdale Springs.

1. Amount retained on 16-mesh sieve.....	5%, passed	99.5%
2. Amount retained on 20-mesh sieve.....	1.0%, passed	98.5%
3. Amount retained on 40-mesh sieve.....	20.5%, passed	78.0%
4. Amount retained on 60-mesh sieve.....	40.0%, passed	38.0%
5. Amount retained on 80-mesh sieve.....	28.0%, passed	10.0%
6. Amount retained on 100-mesh sieve.....	2.0%, passed	8.0%

Granularmetric Analysis of Sand, Sample No. 2.

Old railroad cut, one mile east of Lauderdale Springs.

1. Amount retained on 16-mesh sieve.....	1.0%, passed	99.0%
2. Amount retained on 20-mesh sieve.....	5%, passed	98.5%
3. Amount retained on 40-mesh sieve.....	18.0%, passed	80.5%
4. Amount retained on 60-mesh sieve.....	43.0%, passed	37.5%
5. Amount retained on 80-mesh sieve.....	31.0%, passed	6.5%
6. Amount retained on 100-mesh sieve.....	.5%, passed	6.0%

The percentage of voids is 37; the weight per cubic foot is 83 pounds; the specific gravity is 1.36.

A sample of sand from a creek bed flowing from the cut, exhibited the following degree of fineness:

TABLE NO. 24.

Granularmetric Analysis of Creek Sand, Lauderdale Springs.

	SAMPLE No. 1.	SAMPLE No. 2.
1.	Amount retained on 16-mesh sieve 00%, passed 100%;	1%, passed 99%
2.	Amount retained on 20-mesh sieve 1%, passed 99%;	1%, passed 98%
3.	Amount retained on 40-mesh sieve 32%, passed 67%;	23%, passed 75%
4.	Amount retained on 60-mesh sieve 42%, passed 25%;	42%, passed 33%
5.	Amount retained on 80-mesh sieve 18%, passed 7%;	23%, passed 10%
6.	Amount retained on 100-mesh sieve 1%, passed 6%;	1%, passed 9%

The percentage of voids is 41; the weight per cubic foot is 98 pounds; the specific gravity is 1.57,

LEE COUNTY.

The Selma chalk forms the substratum of Lee County. Its building sands are derived chiefly from the Lafayette and its brick clays from the residual Selma.

Tupelo Sand.—Building sand is obtained for local use west of the lake and southwest of the fertilizer factory in Tupelo. At this point there is a low range of hills capped with Lafayette sands and loams. Near the top of the hills there are pockets of white and yellow sands, which are being utilized. The mechanical condition of the sand is exhibited in Sample No. 1, of the table below. The sand from the hills has been washed down into a small creek valley, lying among the hills. This sand is also used in Tupelo. Its mechanical condition is shown in Sample No. 2 of the following table:

TABLE NO. 25.

Granularmetric Analysis of Tupelo Sand.

	SAMPLE No. 1.	SAMPLE No. 2.
1.	Amount retained on 16 mesh sieve 00.1%, passed 99.9%;	00.1%, passed 99.9%
2.	Amount retained on 20-mesh sieve .2%, passed 99.7%;	00.3%, passed 99.6%
3.	Amount retained on 40-mesh sieve 6.6%, passed 93.1%;	34.9%, passed 64.7%
4.	Amount retained on 60-mesh sieve 68.2%, passed 24.9%;	50.7%, passed 14.0%
5.	Amount retained on 80-mesh sieve 20.6%, passed 4.3%;	11.8%, passed 2.2%
6.	Amount retained on 100-mesh sieve .1%, passed 4.2%;	00.1%, passed 2.1%

The percentage of voids is 41; the weight per cubic

foot is 91 pounds; the specific gravity is 1.46. Below is given the result of a test of tensile strength, a mixture of 1 to 3 with standard cement being used:

No. 1. Briquette.....	256
No. 2. Briquette.....	201
No. 3. Briquette.....	265
Average.....	240

LINCOLN COUNTY.

Lincoln County contains sands and gravels belonging to the Grand Gulf and the Lafayette formations. Its principal source of brick clay is from the Columbia loam.

Bogue Chitto Gravels.—(The following description of the deposit is given by Mr. E. S. Porter): “At the town of Bogue Chitto, in a cut made by the I. C. railroad, a heavy deposit of sand and gravel is exposed. In the west face of the cut, which is from 150 to 200 feet in length, and 15 to 25 feet deep, a five foot bed of nearly pure gravel, 100 to 125 feet long, is shown. The gravel ranging from hickory nut to walnut size. An average of the west face of the cut would probably be: 2 parts gravel, three fine sand, one coarse sand. Judging from the soil and occasional outcrops, it seems probable that the hill upon which the town of Bogue Chitto stands is underlain with sand and gravel.

TABLE NO. 26.

Granularmetric Analysis of Bogue Chitto Gravel.

1. Amount retained on 1½-inch mesh sieve.....	20%,	passed	88%
2. Amount retained on 1 -inch mesh sieve.....	71%,	passed	17%
3. Amount retained on ¾-inch mesh sieve.....	9%,	passed	8%

The percentage of voids is 40; the weight per cubic foot is 120 pounds; the specific gravity is 1.92.



PLATE Xa.—View of a Gravel Pit near Brookhaven. Washing Plant in Foreground.

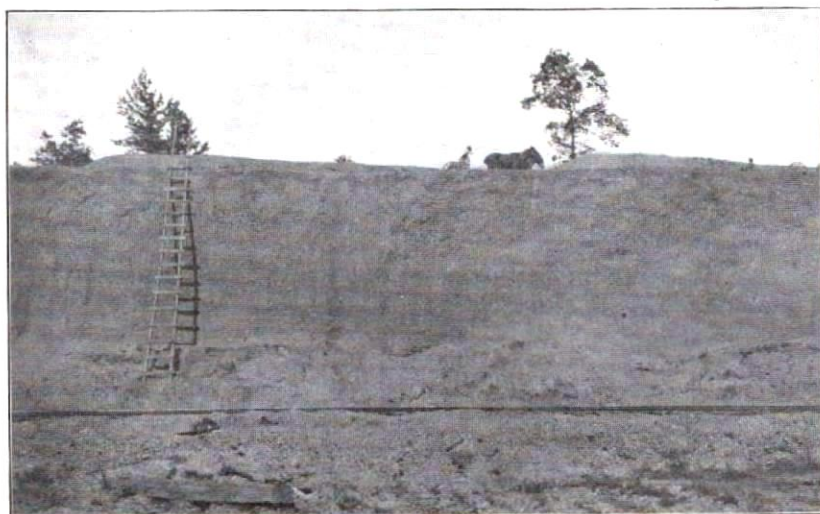


PLATE Xb.—View of a Gravel Pit Seven Miles East of Brookhaven. Face of Pit

LINCOLN COUNTY.

Brookhaven Gravel.—On Old Brook, about two miles south of Brookhaven, is located the McGrath gravel Pit. The stream has cut a trench in the gravel bed and gravel appears on both banks. On the south, the surface of the gravel exposure rises at least 75 feet above the creek bed. The full thickness of the gravel bed is thought to be from 50 to 75 feet. The deposit has been estimated to contain 3 million cubic yards of gravel. The gravel lies on a bed of greenish clay of probably Grand Gulf age. Between this clay and the gravel and sand above is a hard layer of iron oxide, and in places the lowermost gravel is cemented together with iron oxide. In places the gravel contains lenticular masses of nearly pure sand. The voids of the gravel are filled with sand. The gravel pit is being worked by steam shovel and pump. The gravel is being washed before being screened. The pit is connected to the I. C. railroad by a switch. About half of a sample of sand and gravel taken from the bottom of the pit was retained on a 16 mesh sieve.

TABLE NO. 27.

Granularmetric Analysis of Gravel from Bottom of Pit, Brookhaven.

1. Amount retained on 1½-inch mesh sieve.....	10%	passed	90%
2. Amount retained on 1 -inch mesh sieve.....	30%	passed	60%
3. Amount retained on ½-inch mesh sieve.....	34%	passed	26%

The percentage of voids is 44; the weight per cubic foot is 112 pounds.

The sand taken from the above gravel, all of which passed the 16 mesh sieve, has the following degree of fineness:

TABLE NO. 28.

Granularmetric Analysis of Sand from Bottom of Pit, Brookhaven.

1. Amount retained on 20-mesh sieve.....	9%	passed	91%
2. Amount retained on 40-mesh sieve.....	66%	passed	25%
3. Amount retained on 60-mesh sieve.....	20%	passed	5%
4. Amount retained on 80-mesh sieve.....	3%	passed	2%
5. Amount retained on 100-mesh sieve.....	0%	passed	2%

TABLE NO. 29.

Granularmetric Analysis of Gravel from Middle Pit, Brookhaven.

	SAMPLE No. 1.	SAMPLE No. 2.
1.	Amount retained on 1½-inch mesh sieve 00%, passed 100%;	00%, passed 100%
2.	Amount retained on 1 -inch mesh sieve 15%, passed 85%;	15%, passed 85%
3.	Amount retained on ½-inch mesh sieve 50%, passed 35%;	55%, passed 30%

The percentage of voids is 44; the weight per cubic foot is 112 pounds. The sand which passed the 16-mesh sieve exhibited the following degree of fineness:

TABLE NO. 30.

Granularmetric Analysis of Sand from Middle Pit, Brookhaven.

	SAMPLE No. 1.	SAMPLE No. 2.
1.	Amount retained on 20-mesh sieve 21%, passed 79%;	8%, passed 92%
2.	Amount retained on 40-mesh sieve 43%, passed 36%;	51%, passed 41%
3.	Amount retained on 60-mesh sieve 24%, passed 12%;	31%, passed 10%
4.	Amount retained on 80-mesh sieve 9%, passed 3%;	9%, passed 1%
5.	Amount retained on 100-mesh sieve 00%;	passed 3%; 00%; passed 1%

From a red layer of iron-coated sand and gravel near the bottom of the pit the following sample was taken:

TABLE NO. 31.

Granularmetric Analysis of Iron Coated Gravel.

1.	Amount retained on 1½-inch mesh sieve.....	00%, passed 100%
2.	Amount retained on 1 -inch mesh sieve.....	40%, passed 60%
3.	Amount retained on ½-inch mesh sieve.....	30%, passed 30%

The percentage of voids in this gravel is 48; the weight per cubic foot is 114 pounds. The sand taken from the gravel exhibits the following degree of fineness:

TABLE NO. 32.

Granularmetric Analysis of Red Sand, Brookhaven Pit.

1.	Amount retained on 20-mesh sieve.....	28%, passed 72%
2.	Amount retained on 40-mesh sieve.....	61%, passed 11%
3.	Amount retained on 60-mesh sieve.....	10%, passed 1%
4.	Amount retained on 80-mesh sieve.....	0.5%, passed 0.5%
5.	Amount retained on 100-mesh sieve.....	00%, passed .5%

East of Brookhaven.—(The following description is from the notes of Mr. E. S. Porter): “The Brookhaven gravel pits lie about six miles east of the town of Brookhaven, and are on a branch of the I. C. Railroad.

The gravel forms a series of low hills lying on the crest of the river divides. By test drilling the deposit of gravel has been ascertained to be over one hundred feet in thickness. At the time visited, the pit was about a mile and a quarter in length, with a pit face of 40 to 50 feet in height. A washer and set of screens had been installed, enabling the company to turn out seven grades of gravel. At this pit the over-burden is very light, an average of from 2 to 3 feet; the gravel, which is of pigeon to hen's egg size, is free and easily handled. Sand is present in sufficient amount to completely fill the interstices present in the gravel. Although the gravel will stand with an almost vertical face, as shown by the accompanying photograph, yet there is not sufficient cementing material to cause trouble in handling it.”

LOWNDES COUNTY.

The principal source of the building sand of Lowndes County is the Eutaw and the Lafayette. The latter also contains beds of gravel, which have the greatest thickness along the valley of the Tombigbee River.

Columbus Gravel.—The second bottom of the Tombigbee River Valley, at Columbus, is underlain with a bed of gravel and sand, having a thickness of from 5 to 10 feet. The over-burden is clay, which also varies in thickness from 5 to 6 or more feet. The percentage of gravel and the fineness of the sand is revealed in the accompanying table:

TABLE NO. 33.

Granularmetric Analysis of Columbus Gravel and Sand.

1. Amount retained on 16-mesh sieve.....	33.5%, passed	66.5%
2. Amount retained on 20-mesh sieve.....	2.1%, passed	64.4%
3. Amount retained on 40-mesh sieve.....	28.4%, passed	36.0%
4. Amount retained on 60-mesh sieve.....	26.5%, passed	9.5%
5. Amount retained on 80-mesh sieve.....	7.2%, passed	2.3%
6. Amount retained on 100-mesh sieve.....	2%, passed	2.1%



PLATE XIa.—Limestone Ledge on Harvey Place near Mingo Bridge, Tishomingo County.

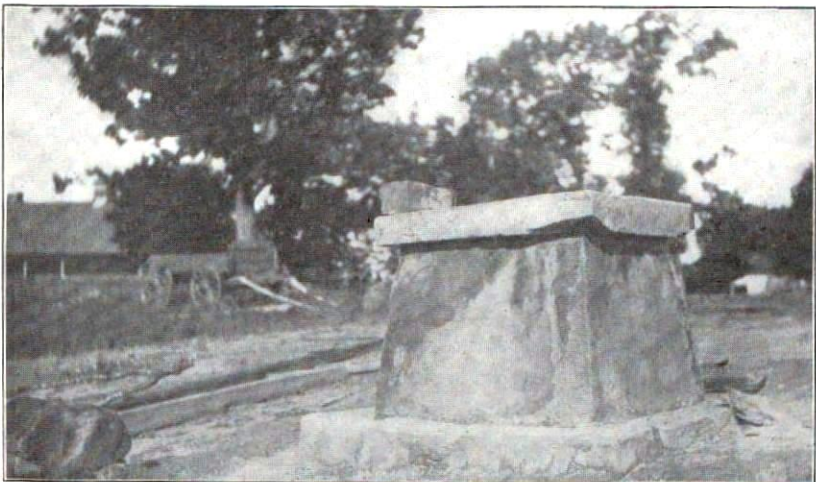


PLATE XIb.—A Well Curb Made of Sandstone, Tishomingo County.

Columbus Sand.—The sand occurring in the layer of gravel at the base of the second bottom is separated from the gravel by screening and used for building purposes within the territory around Columbus. The degree of fineness of this sand is exhibited by the following table:

TABLE No. 34.

Granularmetric Analysis of Columbus Sand.

	SAMPLE No. 1.	SAMPLE No. 2.
1. Amount retained on 16-mesh sieve	4.2%, passed 95.8%	4.2%, passed 95.8%
2. Amount retained on 20-mesh sieve	2.4%, passed 93.4%	3.0%, passed 92.8%
3. Amount retained on 40-mesh sieve	45.5%, passed 47.9%	39.5%, passed 53.3%
4. Amount retained on 60-mesh sieve	36.5%, passed 11.4%	41.7%, passed 11.6%
5. Amount retained on 80-mesh sieve	8.4%, passed 3.0%	9.5%, passed 2.1%
6. Amount retained on 100-mesh sieve	1.0%, passed 2.0%	.1%, passed 2.5%

The percentage of voids is 39; the weight per cubic foot is 93 pounds; the specific gravity is 1.50. The 1-3 mixture of cement and sand gave results as follows, when tested in a tensile strength machine:

	3 Days	90 Days
No. 1. Briquette.....	42 pounds	170 pounds
No. 2. Briquette.....	45 pounds	207 pounds
No. 3. Briquette.....	56 pounds	205 pounds
Average tensile strength.....	48 pounds	194 pounds

MARION COUNTY.

The structural materials of Marion County consist chiefly of sands and gravels occurring in the Grand Gulf and Lafayette formations.

Columbia Gravel and Sand.—A well record given the writer by Mr. C. Oley, a well-driller, concerning the school-house well in Columbia, shows a surface layer of six feet of sand followed by 168 feet of gravel, 70 feet of which he reported as coarse gravel. Deposits of gravel also occur in the Pearl River bluffs west of Columbia.

MARSHALL COUNTY.

The Wilcox formation of Marshall County contains building sands and clays suitable for pottery and other purposes. The Lafayette formation contains sands and thin deposits of gravels.

Holly Springs Sand.—The Wilcox formation at Holly Springs is composed of beds of clay and sand. Erosion of its soft layers has exposed many outcrops of sand. The sand supplies the local need for this kind of structural material. Below is given the granulometric analysis of a sample of sand taken from an exposure of Wilcox sand one-half a mile east of Holly Springs:

TABLE NO. 35.

Granulometric Analysis of Holly Springs Sand.

1. Amount retained on 16-mesh sieve	00.5%, passed	99.5%
2. Amount retained on 20-mesh sieve.....	1.5%, passed	98.0%
3. Amount retained on 40-mesh sieve.....	75.0%, passed	23.0%
4. Amount retained on 60-mesh sieve.....	17.0%, passed	6.0%
5. Amount retained on 80-mesh sieve.....	2.5%, passed	3.5%
6. Amount retained on 100-mesh sieve.....	0.1%, passed	3.4%

The percentage of voids is 39; the weight per cubic foot is 95 pounds; the specific gravity is 1.52. Tensile strength of 1 to 3 mixture of standard cement, after 90 days, is 298 pounds.

MONROE COUNTY.

Monroe County contains building sands derived from the Eutaw and the Lafayette and gravels from the latter. The thickest gravel beds are along the valley of the Tombigbee River.

Amory Gravel.—The town of Amory is built on a terrace of the Tombigbee River. The terrace is composed of a bed of clay and loam, overlying a bed of gravel and sand. The former has a thickness of 8 to 10 feet, while the latter varies from 12 to 20 feet. The gravel layer is exposed

in the clay pit of the Tubbs Brick Plant in Amory, where the over-burden of clay has been stripped off. The gravel is also exposed on the borders of the terrace between the town and the river. An exposure occurs on the Cotton Gin Port Road, about three-quarters of a mile southwest of Amory. A sample of this gravel was given a mechanical separation with the results recorded in the following table:

TABLE NO. 36.

Granularmetric Analysis of Amory Gravel.

1. Amount retained on 1½-inch mesh sieve.....	00.0%, passed	100%
2. Amount retained on 1 -inch mesh sieve.....	22.0%, passed	77.9%
3. Amount retained on ½-inch mesh sieve.....	23.4%, passed	54.5%
4. Amount retained on 1-16-inch mesh sieve.....	14.0%, passed	40.5%

Stockton Gravel.—Gravel outcrops on the Stockton Farm, four miles north of Amory, on the Smithville Road; the total thickness of the bed is not exposed in the outcrop, but well records show a thickness for that part of the valley of from ten to twenty feet. A sample of the gravel taken from the outcrop was subjected to mechanical separation, and the results are recorded in the accompanying table:

TABLE NO. 37.

Granularmetric Analysis of Stockton Gravel.

1. Amount retained on 1½-inch mesh sieve.....	00.0%, passed	100.0%
2. Amount retained on 1-inch mesh sieve.....	11.1%, passed	88.9%
3. Amount retained on ½-inch mesh sieve.....	40.6%, passed	48.3%
4. Amount retained on 1-16-inch mesh sieve.....	32.0%, passed	16.3%

Bigbee Bridge Gravel and Sand.—In the Tombigbee River bed at Amory, there is a deposit of sand and gravel. The deposit occupies a bar on the east side of the stream bed from the wagon bridge down to the Frisco Railroad bridge. The sand and gravel are derived from the second bottom deposits which have been cut into by the river at points higher up. The sand and gravel in this deposit are washed clean by the water of the stream and are used for concrete and plaster. The degree of fineness of the sand is exhibited in the following table:

TABLE NO. 38.

Granularmetric Analysis of Bigbee Bridge Sand.

1. Amount retained on 16-mesh sieve.....	01.5%, passed	98.5%
2. Amount retained on 20-mesh sieve.....	.3%, passed	98.2%
3. Amount retained on 40-mesh sieve.....	8.5%, passed	89.7%
4. Amount retained on 60-mesh sieve.....	71.4%, passed	18.3%
5. Amount retained on 80-mesh sieve.....	16.0%, passed	2.3%
6. Amount retained on 100-mesh sieve.....	0.1%, passed	2.2%

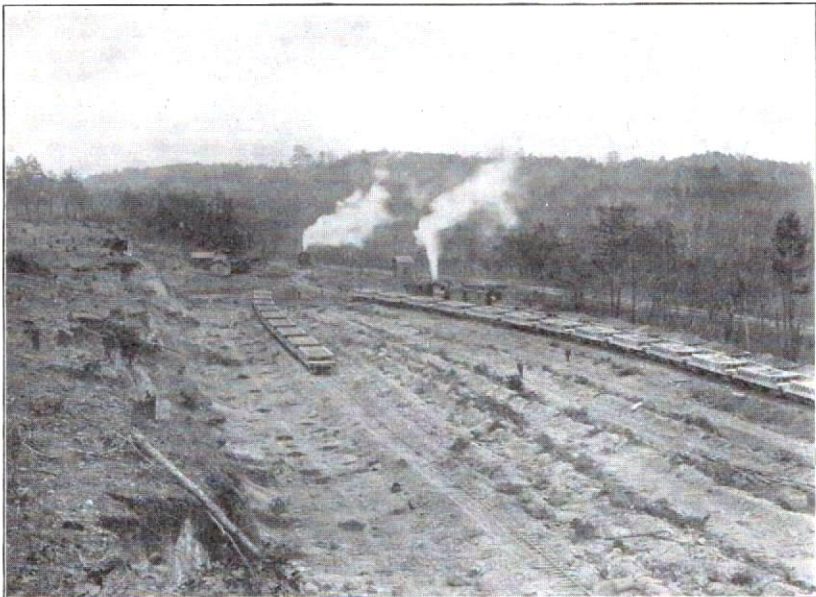
The percentage of voids is 42; the weight per cubic foot is 95 pounds; the specific gravity is 1.50. Tensile strength 227.5 pounds.

A sample of the grave' as taken from the pit was separated with the following results:

TABLE NO. 39.

Granularmetric Analysis of Bigbee Bridge Gravel.

1. Amount retained on 1½-inch mesh sieve.....	16.2%, passed	83.8%
2. Amount retained on 1-inch mesh sieve.....	7.1%, passed	76.7%
3. Amount retained on ½-inch mesh sieve.....	20.3%, passed	56.4%
4. Amount retained on 1-16-inch mesh sieve.....	42.4%, passed	14.0%



PLATE_XII.—A View of a Portion of the Gravel Pit at Gravel Siding, Tishomingo County.

NEWTON COUNTY.

Building sands are obtained from the Tallahatta and the Lafayette formations in Newton County. Though some gravel is present, the amount is usually small.

Newton Sands.—(Taken from notes by Mr. E. S. Porter): "One-fourth west of the town of Newton, in a cut made by the A. & V. Railroad, from 20 to 25 feet of red and purplish sands are exposed. The sand is of medium grain, and of exceptional purity, but little foreign matter being present. The pit at this point has been worked back 3 to 350 feet from the railroad tracks, partly by railroad authorities, and partly to supply the local demand. At present the pit is not worked to any extent.

TABLE NO. 40.

Granularmetric Analysis of Newton Sand.

1. Amount retained on 16-mesh sieve.....	35%, passed	65%
2. Amount retained on 20-mesh sieve.....	5%, passed	60%
3. Amount retained on 40-mesh sieve.....	10%, passed	50%
4. Amount retained on 60-mesh sieve.....	20%, passed	30%
5. Amount retained on 80-mesh sieve.....	20%, passed	10%
6. Amount retained on 100-mesh sieve.....	00%, passed	10%

The percentage of voids is 51; the weight per cubic foot is 87 pounds; the specific gravity is 1.4.

NOXUBEE COUNTY.

The Selma chalk underlies Noxubee County for the most part. The sand and gravel is obtained from the Lafayette.

Prairie Point Limestone.—On the D. Cresswell farm, about one-half mile east of Prairie Point, and 12 miles east of Macon, there is a somewhat resistant layer in the Selma chalk. Rock from this layer has been used in constructing about a half a mile of public road. The rock is too soft to last long in such works. It has an absorption of 16.8%, which is entirely too high for a durable road metal. A chemical analysis of a sample of this limestone is found in the following table:

TABLE NO. 41.

Analysis of Selma Limestone, Cresswell Farm.

(W. S. McNeil, Analyst).

Silica (SiO ₂).....	1.13
Alumina (Al ₂ O ₃).....	.68
Iron Oxide (Fe ₂ O ₃).....	.68
Lime Carbonate (CaCO ₃).....	98.36
Magnesium Carbonate (MgCO ₃).....	trace
Water (H ₂ O).....	.40
Total.....	100.57

The large amount of carbonate of lime found in this limestone, combined with the extremely low percentage of impurities, is an excellent indication of its adaptability to the manufacture of quick lime. A similar limestone is found in the vicinity of Cliftonville, where it forms a capping for a low range of hills.

OKTIBBEHA COUNTY.

The building stone of Oktibbeha County is obtained from the Lafayette and the sandy phases of the Selma. A little sandstone is also obtained from the latter sources.

Oktibbeha Sand.—A sandy place of the Selma chalk yields some sand which accumulates along the creek valleys in Oktibbeha County. This sand is not unmixed with particles from the Lafayette. As a rule, there are shell fragments, iron concretions, and organic matter contained in the sand. The degree of fineness of the sand is exhibited in the following table:

TABLE NO. 42.

Granularmetric Analysis of Oktibbeha Sand.

	SAMPLE No. 1.	SAMPLE No. 2.
1. Amount retained on 16-mesh sieve	1.6%, passed 98.4%	1.8%, passed 98.2%
2. Amount retained on 20-mesh sieve	1.1%, passed 97.3%	1.2%, passed 97.0%
3. Amount retained on 40-mesh sieve	43.5%, passed 53.8%	46.0%, passed 51.0%
4. Amount retained on 60-mesh sieve	42.8%, passed 11.0%	40.5%, passed 10.5%
5. Amount retained on 80-mesh sieve	9.25%, passed 1.75%	9.1%, passed 1.4%
6. Amount retained on 100-mesh sieve	.55%, passed 1.20%	0.0%, passed 1.4%

The percentage of voids is 40; the weight per cubic foot is 95 pounds; the specific gravity is 1.52.

The cement mixture, 1 to 3, tested for tensile strength, as follows:

	3 Days	90 Days
1. Briquette	71	160
2. Briquette	70	180
3. Briquette	69	170
Average tensile strength	70	170

PEARL RIVER COUNTY.

Pearl River County lies within the Grand Gulf Area. Its sands and gravels are derived from the Grand Gulf and the Lafayette.

Bolo Creek Sand.—Along the Pearl River and its tributaries in Pearl River County, there are numerous deposits of fine white sand. Below is given the granulometric analysis of a sample taken from the west prong of Bolo Creek:

TABLE NO. 43.

Granulometric Analysis of Bolo Creek Sand.

1. Amount retained on 16-mesh sieve.....	00.0%, passed	100.0%
2. Amount retained on 20-mesh sieve.....	00.0%, passed	100.0%
3. Amount retained on 40-mesh sieve.....	23.0%, passed	77.0%
4. Amount retained on 60-mesh sieve.....	61.5%, passed	15.5%
5. Amount retained on 80-mesh sieve.....	11.5%, passed	4.0%
6. Amount retained on 100-mesh sieve.....	2.0%, passed	3.8%

The percentage of voids is 38; the weight per cubic foot is 100 pounds; the specific gravity is 1.60.

Poplarville Sand and Gravel.—An outcrop of sand and gravel occurs near the railroad, about one mile north of the N. O. & N. E. station at Poplarville. Only a few feet of gravel are represented in the exposure. There is probably no difficulty in securing sufficient sand and gravel from the outcrops near Poplarville to supply the local demands.

TABLE NO. 44.

Granularmetric Analysis of Poplarville Gravel.

1. Amount retained on 1½-inch mesh sieve.....	00.0%	passed 100.0%
2. Amount retained on 1-inch mesh sieve.....	23.0%	passed 77.0%
3. Amount retained on ½-inch mesh sieve.....	51.0%	passed 26.0%

The percentage of voids is 39; the weight per cubic foot is 97.2 pounds.

TABLE NO. 45.

Granularmetric Analysis of Poplarville Sand.

1. Amount retained on 16-mesh sieve (include in gravel.)		
2. Amount retained on 20-mesh sieve.....	2.0%	passed 98.0%
3. Amount retained on 40-mesh sieve.....	40.0%	passed 58.0%
4. Amount retained on 60-mesh sieve.....	45.0%	passed 13.0%
5. Amount retained on 80-mesh sieve.....	9.0%	passed 4.0%
6. Amount retained on 100-mesh sieve.....	1.0%	passed 3.0%



PLATE XIII.—Opening of the Tishomingo City Gravel Pit. Gravel at Right of Car near Which the Men are Standing.

PIKE COUNTY

The building sands and gravels of Pike County are derived from the Grand Gulf and Lafayette formations.

Osyka.—Gravel occurs in the railroad cut south of the I. C. R. R. station at Osyka, about one-quarter mile, just across the State line. The total thickness of the gravel exposed is about 10 feet, and it has an over-burden of sandy loam and soil of 4 feet. The voids of the gravel are filled with sand. These deposits could be used for road metal without washing. The washed gravel would be suitable for concrete. There seems to be little clay in the deposit.

TABLE No. 46.

Granulometric Analysis of Osyka Gravel.

SAMPLE No. 1. SAMPLE No. 2.

- | | | |
|----|---|------------------|
| 1. | Amount retained on 1½-in. mesh sieve, 00.0%, passed 100.0%; | 00%, passed 100% |
| 2. | Amount retained on 1 -in. mesh sieve 20.0%, passed 80.0%; | 50%, passed 50% |
| 3. | Amount retained on ½-in. mesh sieve 50.0%, passed 30.0%; | 40%, passed 10% |

The percentage of voids is 45; the weight per cubic foot is 106 pounds.

The sand from the above gravel which passed the 16-inch mesh sieve has the following degrees of fineness:

TABLE No. 47.

SAMPLE No. 1. SAMPLE No. 2.

- | | | |
|----|---|-----------------|
| 1. | Amount retained on 20-mesh sieve, 13%, passed 87%; | 17%, passed 83% |
| 2. | Amount retained on 40-mesh sieve, 48%, passed 39%; | 49%, passed 34% |
| 3. | Amount retained on 60-mesh sieve, 18%, passed 21%; | 17%, passed 17% |
| 4. | Amount retained on 80-mesh sieve, 8%, passed 13%; | 8%, passed 9% |
| 5. | Amount retained on 100-mesh sieve, 13%, passed 10%; | 2%, passed 7% |

RANKIN COUNTY.

Rankin County contains limestones belonging to the Vicksburg formation, sandstones belonging to the Grand Gulf and sands of Lafayette age.

Brandon Sand.—Building sands occur in the vicinity of Brandon in connection with the Lafayette formation.

A bed of white, coarse, sharp sand is found along the old railroad cut which comes toward the town from the west. The sample, an analysis of which is given below, was taken from a creek bed about one mile east of Brandon.

TABLE NO. 48.

Granularmetric Analysis of Brandon Sand.

1. Amount retained on 16-mesh sieve.....	.1%, passed	99.0%
2. Amount retained on 20-mesh sieve.....	.2%, passed	97.0%
3. Amount retained on 40-mesh sieve.....	57.5%, passed	39.5%
4. Amount retained on 60-mesh sieve.....	35.0%, passed	4.5%
5. Amount retained on 80-mesh sieve.....	3.9%, passed	0.6%
6. Amount retained on 100-mesh sieve.....	.2%, passed	.4%

The percentage of voids is 40; the weight per cubic foot is 99 pounds; the specific gravity is 1.59.

Brandon Limestone.—Some excellent exposures of Vicksburg limestone are found in this locality. An outcrop occurs at the foot of the bluff just east of the A. & V. Station. On the Robinson farm, 4 miles southeast of Brandon, there is a stone quarry in which six layers of limestone are found interbedded with marl in the following stratigraphical order:

Section of Vicksburg at Robinson Quarry, near Brandon.

13. Soil and decomposed rock.....	2 feet
12. Limestone.....	1 to 1½ feet
11. Marl.....	1 foot
10. Limestone.....	2 feet
9. Marl.....	2 feet
10. Limestone.....	1¼ feet
7. Marl.....	1½ feet
6. Limestone.....	1¼-2 feet
5. Marl.....	2 feet
4. Limestone.....	2 feet
3. Marl.....	1¼ feet
2. Limestone.....	2 feet
1. Marl.....	2 feet

The limestone is a bluish tint on fresh surfaces, but weathers white on exposure. It is very fossiliferous, containing abundant evidence of marine life. Large

quantities of this stone have been shipped for use in rip-rap work. It has also been used locally for building purposes. It has an absorption of only 5.4 per cent.

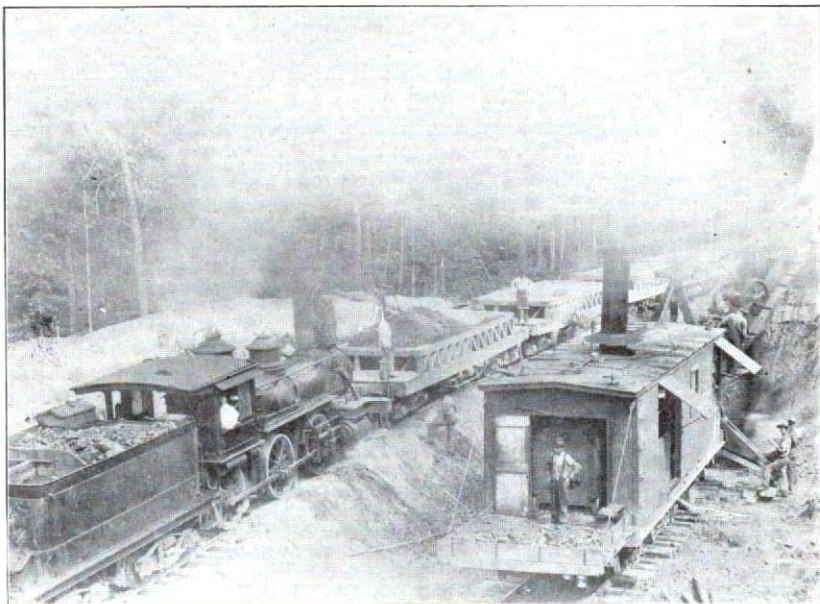


PLATE XIV.—A Gravel Train in Tishomingo County, Loading at the Pit.

SIMPSON COUNTY.

The Grand Gulf and the Lafayette of Simpson County each contain sands and gravels which can be used for structural purposes.

Weatherby Gravel.—The following description of the outcrop is given by Mr. E. S. Porter:

“A mile east of Weatherby on the G. & S. I. R. R. lies what is known as the ‘Weatherby Gravel Pit,’ an excavation from 1000 to 1100 feet in length, running N. E. to S. W., at places very nearly north and south, with a maximum thickness of 40 to 45 feet north of the center of the pit. Not all of the entire pit face supplies first-class gravel, 200 to

300 feet of the southern end having a large amount of sand and clay in with an overburden of 10 to 12 feet of dark red sand. The northern end has a high-grade gravel, but likewise an overburden of red sand, similar to that at the southern end, and in addition, large masses of the sand and gravel are so cemented by iron oxide as to form a conglomerate of sufficient strength to, in some places at least, interfere seriously with working of the gravel.

“The north central portion of the pit, 40 to 45 feet in height, and 500 to 600 feet in length, is of excellent quality, and easily worked. The overburden ranges from 8 to 6 feet, and is a mixture of sand and gravel shading into the main deposits. In the main body, the gravel is of brownish color, ranging from hazelnut to pigeon egg, or walnut, in size, with just enough sand present to fill in the voids. In some places, notably the upper central part of the north central portion of the pit face, there is a high percentage of clay mingled with the sand, which fills the interstices of the gravels. Throughout the entire portion, which has just been discussed, no lenses of clay or conglomerate, due to iron oxide cementation, is found, although 15 to 20 clay balls, from 8 to 10 inches through, were noticed in the pit face, but these were not of sufficient number or size to interfere with the working of the gravel.

“The lower limit of the beds at this point is not known, but from the fact that in the center of the worked out area, beds of blue clay are exposed, it is judged that the gravel extends but little, if any, below its present working base.

“The surface extent of these deposits is not known, but, owing to the gravelly nature of the soil, and shape of the hill, it is thought that the entire hill to the east is underlain with the same kind of material.

“So far as is known, these deposits have been opened and worked exclusively for railroad purposes.”

TABLE NO. 49.

Granularmetric Analysis of Gravel (bottom ledge.)

1. Amount retained on 1½-inch mesh.....	00%	passed 100%
2. Amount retained on 1-inch mesh.....	16%	passed 84%
3. Amount retained on ½-inch mesh.....	39%	passed 45%

The percentage of voids is 45; the weight per cubic foot is 96 lbs.

TABLE NO. 50.

Granularmetric Analysis of Sand (bottom layer).

1. Amount retained on 20-mesh sieve.....	24%	passed 76%
2. Amount retained on 40-mesh sieve.....	46%	passed 30%
3. Amount retained on 60-mesh sieve.....	15%	passed 15%
4. Amount retained on 80-mesh sieve.....	6%	passed 9%
5. Amount retained on 100-mesh sieve.....	2%	passed 7%

TABLE NO. 51.

Granularmetric Analysis of Sand from Red Layer.

1. Amount retained on 20-mesh sieve.....	18%	passed 82%
2. Amount retained on 40-mesh sieve.....	68%	passed 14%
3. Amount retained on 60-mesh sieve.....	9%	passed 5%
4. Amount retained on 80-mesh sieve.....	2%	passed 3%
5. Amount retained on 100-mesh sieve.....	0%	passed 3%

TABLE NO. 52.

Granularmetric Analysis of Gravel from Red Layer.

1. Amount retained on 1½-inch mesh.....	00%	passed 100%
2. Amount retained on 1-inch mesh.....	00%	passed 100%
3. Amount retained on ½-inch mesh.....	8%	passed 92%

TABLE NO. 53.

Granularmetric Analysis of Sample of Average Gravel.

1. Amount retained on 1½-inch mesh.....	00%	passed 100%
2. Amount retained on 1-inch mesh.....	11%	passed 89%
3. Amount retained on ½-inch mesh.....	30%	passed 59%

TABLE NO. 54.

Granularmetric Analysis of Average Sand.

1. Amount retained on 20-mesh sieve.....	31%	passed 69%
2. Amount retained on 40-mesh sieve.....	31%	passed 38%
3. Amount retained on 60-mesh sieve.....	18%	passed 20%
4. Amount retained on 80-mesh sieve.....	13%	passed 7%
5. Amount retained on 100-mesh sieve.....	4%	passed 3%

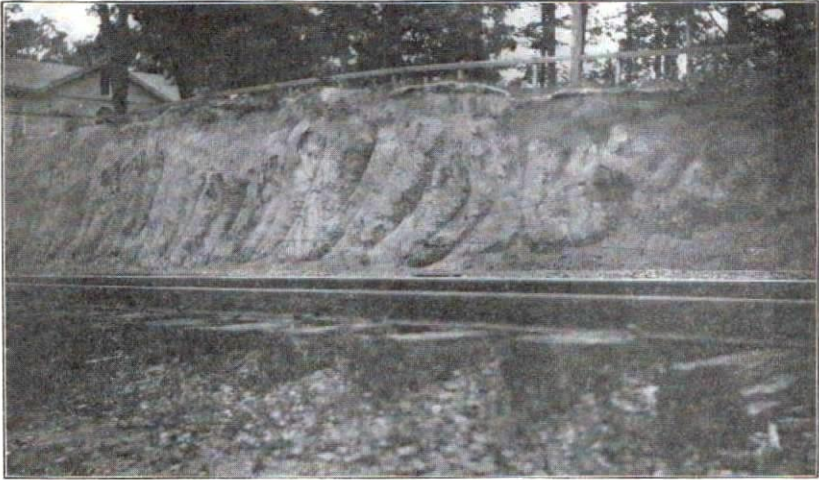


PLATE XVa.—An Exposure of Molding Sands Belonging to the Eutaw Formation.



PLATE XVb.—Masses of Conglomerate Formed by the Ferruginous Cementation of the Tuscaloosa Gravel, Tishomingo County.

TIPPAH COUNTY.

The formations of Tippah County which contain structural materials are the Ripley, the Clayton and the Lafayette. The Ripley contains limestone and sand, the Clayton limestone, and the Lafayette sands.

Ripley.—Deposits of sand of Lafayette age cover the top of the hills three miles west of Ripley. The hills are composed chiefly of Porters Creek clay, with a capping of Lafayette. The latter consists principally of sand, with some irregular layers of ironstone. The beds of sand are thickest on the slopes of the hill, where it has gradually accumulated through the erosion of the hill tops. In some places the sand is white and very pure, but the beds are often stained with iron compounds. The sand is used in Ripley for building purposes.

The fineness of its grain is shown in the following table:

TABLE NO. 55.

Granularmetric Analysis of Ripley Sand.

	SAMPLE No. 1.	SAMPLE No. 2.
1. Amount retained on 16-mesh sieve	00.0%, passed 100.0%	00.0%, passed 99.3%
2. Amount retained on 20-mesh sieve	0.2%, passed 99.8%	2.3%, passed 97.0%
3. Amount retained on 40-mesh sieve	60.7%, passed 39.1%	59.0%, passed 38.0%
4. Amount retained on 60-mesh sieve	28.7%, passed 10.4%	31.7%, passed 6.3%
5. Amount retained on 80-mesh sieve	7.8%, passed 2.6%	5.0%, passed 1.3%
6. Amount retained on 100-mesh sieve	.2%, passed 2.4%	.1%, passed 1.2%

The percentage of voids is 39; the weight per cubic foot is 95 pounds; the specific gravity is 1.53.

The cement mixture (1 to 3), exhibited tensile strength as follows:

	3 Days	90 Days
No. 1. Briquette82 pounds	210 pounds
No. 2. Briquette55 pounds	195 pounds
No. 3. Briquette90 pounds	190 pounds
Average tensile strength76 pounds	198 pounds

Owl Creek Bluff.—On the Hill farm, on the Owl Creek, east of Ripley, there is an exposure of dark, marly sand, filled with shells. Portions of the limestone are very

soft, and the eroded surface is extremely pitted. The limestone is not suitable for structural purposes. It could be crushed and used for the liming of lands. The shell rock has an absorption of 9 per cent.

Blue Mountain.—An outcrop of Ripley limestone and marl is located on the Garrison farm, about 7 miles east of Blue Mountain. The properties of the stone are similar to those recorded above.

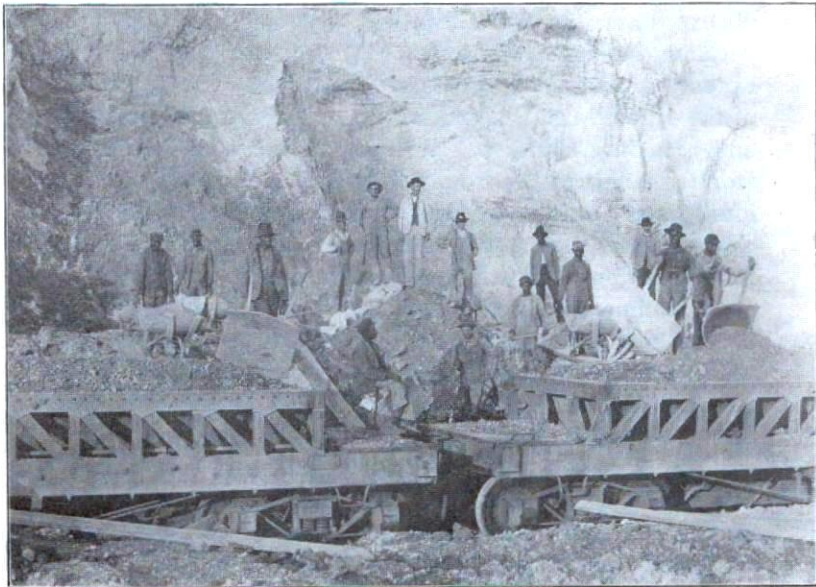


PLATE XVI.—Loading Gravel Cars by Hand at Gravel Siding, Tishomingo County.

TISHOMINGO COUNTY.

Tishomingo County contains a great variety of structural materials. These come from both the bed rock and the mantle rock formations. The Devonian contains beds of limestone and shales; the Sub-Carboniferous beds of limestone, sandstone, shale, chert and silica; the Tuscaloosa contains gravels, sands and clays; the Eutaw formation contains sands and clays, and the La-

fayette sands, gravels and ironstones. No county in the State is better supplied with structural materials.

Old Eastport Limestone.—On the south bluff of the Tennessee River, near the site of Old Eastport, there is an outcrop of bluish colored limestone. This limestone is best exposed at a point where the wagon road passes down toward the boat landing. At this point some of the limestone has been quarried for building purposes. The stone is compact and non-fossiliferous at the point of exposure. At Bluff Spring, west of this exposure, perhaps one-half mile, a small stream has cut into and exposed a section of the same limestone. The thickness of the exposed bed is about 25 feet. The rock is laminated and of a dark, bluish color. The stream bed in the limestone is marked by small falls and pot holes. Lying immediately above the limestone is a bed of fossiliferous cherts. The chert bed is the source of the water supply for the springs which feed the small stream.

The limestone bed forms one of the basal members of the rocks composing the prominent escarpment extending from Old Eastport up beyond the mouth of Indian Creek, which lies to the west, and is one of the tributaries of the Tennessee River.

The limestone is probably very near the contact between the Devonian and the Sub-Carboniferous formations, as the chert which lies above contains Sub-Carboniferous fossils.

A sample of the limestone showed an absorption of less than 1 per cent. It was subjected to freezing temperatures three times, without loss in weight or cracking. The chemical analysis of the limestone is given in the following table:

TABLE NO. 56.

Analysis of Eastport Limestone.

Constituent	Per Cent
Moisture (H ₂ O).....	0.40
Volatile matter (CO ₂ etc)	5.06
Silicon Dioxide (SiO ₂)	43.18
Iron Oxide (Fe ₂ O ₃)	3.13
Aluminum Oxide (Al ₂ O ₃)	3.43
Calcium Oxide (CaO)	39.47
Magnesium Oxide (MgO)	3.19
Sulphur Trioxide (SO ₃).....	2.23
Total.....	100.09

Indian Creek Limestone. Near the mouth of Indian Creek, which is a tributary of the Tennessee River, heading in the vicinity of Iuka, and flowing northward, there are outcrops of Devonian limestone. The bottom layers exposed in the channel of Goodman Creek, a small tributary, and dark blue and very compact. The chemical analysis of a sample is given in the table below:

TABLE NO. 57.

Analysis of Indian Creek Limestone, Tishomingo County.

Constituent	Per Cent
Moisture.....	.40
Volatile matter (CO ₂ , etc)	24.10
Silicon Dioxide (SiO ₂).....	42.00
Aluminum Oxide (Al ₂ O ₃).....	1.98
Iron Oxide (Fe ₂ O ₃).....	6.02
Calcium Oxide (CaO).....	23.25
Magnesium Oxide (MgO).....	.27
Sulphur Trioxide (SO ₃).....	1.50
Total.....	99.52

The limestone occurs in thick layers, which are intersected by two sets of joint planes. The full thickness of the bed is not exposed, but at the point where Goodman Creek enters the Tennessee Valley, there are exposures of 25 feet or more. The limestone shows a degree of absorption of only .25 per cent, and is little affected by freezing.

Cypress Pond Limestone.—A swamp area on the north side of the road near Mingo Bridge is called Cypress Pond. A small creek enters the swamp from the west. Along the south bank of the creek there is an exposure of limestone. The thickness of the outcropping bed is about 15 feet, though the full thickness is not revealed. One layer contains large quadrangular blocks, having a thickness of 7 feet. The chemical analysis of a sample of the limestone is given in the following table:

TABLE NO. 58

Analysis of Cypress Pond Limestone.

Constituent	Per Cent
Moisture (H ₂ O).....	1.10
Volatile matter (CO ₂).....	27.00
Silicon Dioxide (SiO ₂).....	10.91
Iron Oxide (Fe ₂ O ₃).....	5.00
Aluminum Oxide (Al ₂ O ₃).....	8.71
Calcium Oxide (CaO).....	47.06
Magnesium Oxide (MgO).....	0.16
Sulphur Trioxide (SO ₃).....	0.85
Total.....	100.25

This limestone contains some bituminous matter, which ignites after being held for a short time in a flame. It exhibits an absorption of only .1 per cent. This low absorption may be due to the bituminous matter which it contains. When heated, sufficient bitumen exudes to change the color of the rock from gray to black. This limestone may be the source of the bitumen contained in the sandstone which overlies the limestone to the south of this outcrop.

The Cypress Pond limestone has been used locally for building purposes and there is no doubt that its use for such purposes could be very profitably extended. The amount of impurities revealed by the chemical analysis may prohibit its use for the manufacture of lime. However, the sample was taken from the top of the bed and the lower beds may contain less of these impurities. As a road metal it will probably be found to be more serviceable than the average limestone.

Mingo Bridge Sandstone.—In the bed of Bear River, above Mingo Bridge, there is a bed of sandstone containing considerable bituminous matter of an asphaltic nature. This sandstone overlies the limestone referred to above. It occurs in layers of from four inches to one foot or more in thickness. Fragments of the stone, when passed through the flame of a burner, will ignite and burn with a smoky flame and give off an asphaltic odor. The sandstone has an absorption of 1.6 per cent. The bitumen seems to fill the pores of the rock almost completely.

The sandstone will prove useful for structural purposes probably as a top dressing for roads.

Gardner Sandstone—On the Gardner place, south of Mingo Bridge on the west bank of Bear River there is an extensive exposure of a white, fine-grained sandstone. The layers in the outcrop vary in thickness from a few inches to several feet. The upper portion of the stratum is broken up into huge rectangular blocks, which lie scattered along the surface of the river slope. One of these blocks measures 40 by 10 by 12 feet. The sandstone has been used locally for building purposes. It has been used chiefly in the construction of chimneys, foundations and walls of houses, well curbs, and for flags. One of the chimneys, which was constructed in 1852, is still in good repair. The absorption of the sandstone is 5.5 per cent. A sample of the stone was subjected to a freezing mixture three different times and was very little affected.

Bay Springs Sandstone.—Where the wagon bridge spans Mackey Creek at Bay Springs, there is a thick bed of sandstone occupying both banks of the stream. The thickness of the layer is about 30 feet. At the east end of the bridge, several large blocks have been broken off the ledge. One block measures 20 by 10 by 8 feet. The properties of the stone are similar to those of the Gardner stone.

Gravel Siding Gravel.—A thick bed of gravel is located along the line of the Southern Railroad east of Iuka at Gravel Siding. The gravel pits located at this point have been worked for many years by the railroad company and others. A great many hundreds of carloads of gravel have been shipped from this point. The gravel is a white chert, which has been worn smooth by water action. A square foot of surface near the bottom of the pit contained thirteen gravels one inch, and larger in diameter. The largest gravel were seven inches in their longest diameter.

In the eastern part of the pit, there is a ridge of gravel extending back about one-half mile from the face of the pit. The height of the ridge at the pit is about 50 feet.

Near the western edge of the pit there is a ridge of gravel about 60 feet in height, extending back for a quarter of a mile from the face of the pit. The ridge is about ten rods wide at the base, and probably contains as much as 5,000 carloads of gravel. The gravel is stratified in part and in places contains layers of finely divided silica and a little white clay. When a sample of the finely divided silica was subjected to a physical examination, 44% had the fineness of clay, and the remainder was of the fineness of very fine sand.

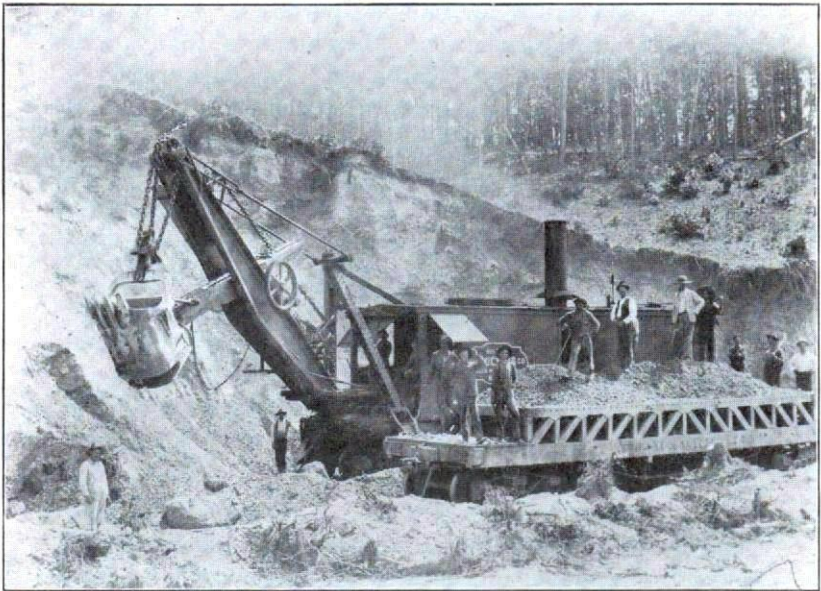


PLATE XVII.—Loading Cars With Steam Shovel at Gravel Siding, Tishomingo County.

A mine-run sample of the gravel was separated in order to determine its relative degree of fineness. The results are given in the accompanying table:

TABLE NO. 59.

Granularmetric Analysis of Tishomingo Gravel, Sample No. 1.

1. Amount retained on 1½-inch mesh sieve.....	4.3%, passed	95.7%
2. Amount retained on 1-inch mesh sieve.....	8.2%, passed	87.5%
3. Amount retained on ½-inch mesh sieve.....	23.2%, passed	64.3%
4. Amount retained on 1-16-inch mesh sieve.....	40.4%, passed	23.9%

Granularmetric Analysis of Tishomingo Gravel, Sample No. 2.

1. Amount retained on 1½-inch mesh sieve.....	74.9%, passed	25.1%
2. Amount retained on 1-inch mesh sieve.....	19.8%, passed	5.3%
3. Amount retained on ¾-inch mesh sieve.....	2.3%, passed	3.0%
4. Amount retained on 1-16-inch mesh sieve.....	0.0%, passed	3.0%

The second sample was taken from another portion of the pit and part of the fine material had been washed out by the rainwater.

Tishomingo City Gravel.—A few hundred yards south of the station at Tishomingo City, there is a deposit of water-worn chert gravel of considerable thickness. This gravel has been used for local structural purposes and also shipped to Corinth and other places. The main bed of gravel probably belongs to the Tuscaloosa formation, but the more superficial deposits containing smaller gravel and more sand, are probably of Lafayette age. The outcrop on the east side of the track is owned by the Tishomingo City Gravel Company. A little farther south, on the J. E. Norman place, the outcrop covers eight to nine acres, and the deposit has a thickness of from 20 to 30 feet. The mechanical condition of these two gravels is recorded in the following table:

TABLE NO. 60.

Granularmetric Analysis of Tishomingo City Gravel, Sample No. 1.

1. Amount retained on 1½-inch mesh sieve.....	00.0%, passed	100.0%
2. Amount retained on 1-inch mesh sieve.....	3.1%, passed	96.9%
3. Amount retained on ¾-inch mesh sieve.....	4.4%, passed	92.5%
4. Amount retained on 1-16-inch mesh sieve.....	83.5%, passed	9.0%

Granularmetric Analysis of Tishomingo City Gravel, Sample No. 2.

1. Amount retained on 1½-inch mesh sieve.....	07.5%, passed	92.5%
2. Amount retained on 1-inch mesh sieve.....	39.5%, passed	53.0%
3. Amount retained on ¾-inch mesh sieve.....	45.3%, passed	7.7%
4. Amount retained on 1-16-inch mesh sieve.....	7.2%, passed	0.5%

The first sample was taken from the Norman pit, and the second from the Tishomingo City Gravel Company's pit.

Dennis Gravel.—A small creek, running southwest from Dennis, cuts down through a bed of gravel and leaves exposures on both sides of the valley, which is about one-eighth of a mile wide. Large gravel are found at the base of a hill one mile west of Dennis, and half a mile farther to the west, the following section is exposed:

Section West of Dennis.

1. Red sand (top).....	10 feet
2. Laminated clay and sand.....	12 feet
3. White chert gravel.....	15 feet
4. White, yellow and red clay.....	10 feet

Clear Creek Gravel.—Outcrops of beds of gravel occur on both sides of Clear Creek, from Gravel Siding to Bear River. The thickness of these beds are probably as great, if not greater, than the thickness of the beds at Gravel Siding. Beds of conglomerate form prominent resistant ledges in places.

Indian Creek Chert.—Indian Creek, in its lower course, cuts its channel into the Sub-Carboniferous and Devonian rocks, exposures of which occur on both sides of the creek. The beds contain at the base a bed of bluish colored limestone. The beds of chert and gravel, which lie above this limestone, have a thickness of 250 or 300 feet. The body of the ridge is composed of chert, and are capped with about 25 to 50 feet of chert gravel, probably belonging to the Tuscaloosa. These beds of chert occur in the following sections:

1. Northwest quarter of Section 18.
2. Northeast quarter of Section 18.
3. Southwest quarter of Section 7.
4. Northwest quarter of Section 8.
5. Southwest quarter of Section 8.

UNION COUNTY.

Union County contains four geological formations in its subsurface. The Selma occupies the eastern part of the county, the Ripley the central part, and the Eocene beds the western portion. The surficial deposits are the

Lafayette and the Columbia. Limestones occur in the Ripley and Clayton and sands in the Wilcox and the Lafayette.

Ellistown Limestone.—At Ellistown, in the eastern part of Union County, there is a range of hills formed of Ripley limestone and capped with Lafayette. A prominent ledge of limestone lying beneath a bed of micaceous sand and clay has been used for the making of lime.

WARREN COUNTY.

The principal structural materials of Warren County are limestones from the Vicksburg, sandstones from the Grand Gulf and sand and gravels from the Lafayette.

Vicksburg.—The Vicksburg formation received its name from the city of Vicksburg, located on the bluffs of the Mississippi, at the confluence of the Yazoo. The Vicksburg limestone underlies the city and outcrops along the bluffs of the river. The limestone occurs in layers interbedded with marls and clays. The thickness of the layers varies from 1 1-2 to 5 feet. The amount of overburden and interbedding, in many places, will prevent the economical utilization of the limestone unless some use can be found for the former. The following section is exposed near the Oil Mill at Vicksburg:

TABLE NO. 61.

Section of Vicksburg Limestone at the Old Mill, 2 1-4 miles South of Vicksburg.

9. Loess in the bluff back from the river.....	100 feet
8. Marl.....	2 feet
7. Ledge of hard limestone.....	3 feet
6. Bed of soft marl.....	3 feet
5. Ledge of limestone.....	5 feet
4. Marl stratum.....	5 feet
3. Ledge of hard limestone.....	5 feet
2. Hard limestone.....	3 feet
1. Bed of compact marl.....	5 feet
Water's edge.	

The thickness of the exposure in the above section

is about one-third of the entire thickness of the Vicksburg formation.

Analysis of each stratum from Nos. 1 to 7, inclusive, was made with the following results. The numbers of the analyses correspond to the numbers in the above section.

TABLE NO. 62.

Analyses of Vicksburg Limestones and Marls from Vicksburg.

Constituent	Per Cent.			
	No. 1	No. 2.	No. 3.	No. 4.
Silica (SiO ₂).....	32.45	6.43	7.39	25.27
Alumina (Al ₂ O ₃).....	2.12	0.31	1.02	4.50
Iron Oxide (Fe ₂ O ₃).....	2.05	2.00	2.48	5.37
Lime (CaO).....	34.20	50.25	47.50	29.50
Volatile matter (CO).....	26.65	39.00	38.65	24.10
Magnesium Oxide (MgO).....	.38	1.36	1.45	1.99
Sulphur Trioxide (SO ₃).....	.08	.36	.51	2.76
Moisture (H ₂ O).....	1.60	.61	1.10	3.95
Total.....	99.53	100.32	100.10	97.34

TABLE NO. 63.

Analyses of Vicksburg Limestones and Marls from Vicksburg.

Constituent	Per Cent.			
	No. 5	No. 6	No. 7	No. 8
Silica (SiO ₂).....	5.58	13.62	3.10	7.08
Alumina (Al ₂ O ₃).....	1.00	3.00	.25	.61
Iron Oxide (Fe ₂ O ₃).....	2.18	2.75	1.62	2.50
Lime (CaO).....	49.97	40.37	50.63	50.44
Volatile Matter (CO ₂).....	36.26	33.66	41.00	37.22
Magnesium Oxide (MgO).....	1.01	1.72	.99	1.07
Sulphur Trioxide (SO ₃).....	.30	.98	.60	.38
Moisture (H ₂ O).....	.82	2.75	.60	.40
Total.....	100.12	98.85	98.79	97.70

An average of Nos. 1, 2, 3, 4, 5, 6, 7, 8.

Constituent	Per cent
Silica (SiO ₂).....	13.41
Alumina (Al ₂ O ₃).....	1.74
Iron Oxide (Fe ₂ O ₃).....	2.63
Lime (CaO).....	43.20
Volatile Matter (CO ₂).....	34.62
Magnesium Oxide (MgO).....	1.29
Sulphur Trioxide (SO ₃).....	.79
Moisture (H ₂ O).....	1.63
Total.....	99.31

No. 8 is a limestone from Steel's Bayou, Vicksburg. See Bulletin No. 1, of the Survey Reports.

WAYNE COUNTY.

Wayne County contains outcrops of Vicksburg limestone which can be used for the manufacture of lime and for building purposes. The Lafayette of this county contains workable beds of sand and gravel.

Waynesboro.—Along the base of the second bottom, terraces of the Chickasawhay River, there are outcrops of sand and gravel. The gravel is composed of small, rounded quartz pebbles. The sand is usually iron-stained, rounded quartz grains, but often weathers out into white or gray beds. The mechanical condition of a sample taken from the Chickasawhay Valley near Waynesboro is given in the accompanying table:

TABLE NO. 64.

Granularmetric Analysis of Waynesboro Sand.

1. Amount retained on 16-mesh sieve.....	06.3%, passed	93.7%
2. Amount retained on 20-mesh sieve.....	1.6%, passed	92.1%
3. Amount retained on 40-mesh sieve.....	26.2%, passed	65.9%
4. Amount retained on 60-mesh sieve.....	42.3%, passed	23.6%
5. Amount retained on 80-mesh sieve.....	17.1%, passed	6.5%
6. Amount retained on 100-mesh sieve.....	1.6%, passed	4.9%

The tensile strength of the cement mixture, 1 to 3, is given below:

	3 Days.	90 Days
No. 1. Briquette	90 pounds	255 pounds
No. 2. Briquette	92 pounds	250 pounds
No. 3. Briquette	75 pounds	232 pounds
Average tensile strength	86 pounds	248.5 pounds

Waynesboro.—A ledge of Vicksburg limestone outcrops in the bed of the Chickasawhay River above the wagon bridge at Waynesboro and along the banks of the river up to the mouth of Yellow Creek, a western tributary of the Chickasawhay River. There are also exposures of limestone along the banks of Yellow Creek for a distance of three or four miles up the creek, the channel of the stream having been carved in the limestone. On the Plummer place, up Yellow Creek, about three miles from Waynesboro, a quarry has been opened in the limestone. The

limestone is soft and easily cut with a saw. In quarrying the rock is sawed out in blocks. After losing some quarry water, they become slightly indurated. The stone has been used only locally in the building of chimneys and for foundations for houses. A sample of the limestone disintegrated badly when placed in water for the purpose of testing its absorptive power.

Nancy.—South of Nancy, in Wayne County, there are some outcrops of Vicksburg limestone. At one or two places quarries have been opened. The limestone is soft and the usual method of quarrying is to saw it out in blocks. These blocks have been used principally in the building of chimneys. Some of the chimneys have been in use for many years. For chemical analysis, see the following table:

TABLE NO. 65.

Analysis of Vicksburg Limestone, Wayne County.

Constituent	Per Cent
Moisture (H ₂ O).....	1.79
Volatile Matter (CO ₂ , etc).....	35.40
Silicon Dioxide (SiO ₂).....	6.77
Iron Oxide (Fe ₂ O ₃).....	2.00
Aluminum Oxide (Al ₂ O ₃).....	4.68
Calcium Oxide (CaO).....	45.51
Magnesium Oxide (MgO).....	.64
Sulphur Trioxide (SO ₃).....	3.00
Total.....	99.79

Structural Materials of Mississippi

Supplement

June, 1913

APPENDIX.

By E. N. LOWE.

In the preparation of the foregoing report, by an inadvertence, mention of the extensive and valuable deposits of chert gravel occurring along the bluff hills that fringe the Delta lowlands was omitted. These gravel deposits follow the edge of the uplands that border the Yazoo-Mississippi Delta, extending practically from Memphis to the Louisiana line. In many places, however, the thickness of the gravel beds is not great and the overburden is heavy, so that much of the gravel cannot be recovered economically. Sufficient can be recovered to justify the belief that when development of this region takes place it will be one of the State's most valuable gravel resources.

These gravels differ from those of northeast Mississippi in being more uniform in size, more rounded and water-worn, brownish-yellow in color instead of yellowish-white, as in the case of the Tishomingo gravels, and in having, on the whole, a more sandy and less tenacious cementing material. The gravel is usually associated with yellowish-red sand deposits which are but imperfectly stratified, in places showing no stratification for long distances. The sands usually overlie the gravel beds to a thickness of from a few feet to twenty-five or thirty feet. The gravel deposits themselves may be but a foot or two in thickness, but are usually much greater, in places a hundred feet or more.

The geological age of these gravels is latest Tertiary or Pleistocene, and it is possible that the deposits are not all of the same age, some seeming to represent re-worked material of an original older gravel deposit. Their occurrence along the border of the Delta would suggest an old river deposit. This fringe of gravel does not extend eastward of the old river bluffs further than 15 or 20 miles, and gradually thins in that direction, as a rule. The gravel underlies the Loess silt wherever they are associated, indicating a greater age, and an interesting fact is that the two formations in the north half of Mississippi have the same general distribution. Another significant fact is that in many places there seems to be no break between the formations, the overlying loam and loess seeming to grade down into the sand and gravel deposits, and in at least one locality the shells of the loess and the gravels of the lower deposit were intermingled. In many places

the gravel and sand deposits appear to be a basal phase of the loess loam. The chert from which the pebbles were derived is Carboniferous in age as shown by carboniferous fossils very commonly found in them. Indeed, the pebbles themselves are sometimes crinoids or brachiopods or other forms of carboniferous fossils.

Few pits have been opened in this gravel region, which accounts for its being less well known than the Eastern gravel. A pit of large dimensions was opened many years ago at Rosetta, in Wilkinson County, on the Mississippi Valley Railroad, and the gravel was extensively used on the railroad and was shipped to New Orleans and elsewhere for street paving. The pit is one mile southeast of the station at Rosetta. An old spur of the railroad runs to it, but was not used at the time of our visit, the pit having been abandoned several years. The pit shows a face of about 35 feet in height and 125 yards long, all being gravel except about five feet of overlying loam toward the south end, the gravel coming to the surface farther to the north. Ten feet of orange colored sand is sandwiched between the loam and the pebble beds in places. The gravel is of the usual brown and fawn colored chert with occasional transparent quartz pebbles. At certain levels great bands 4 to 5 feet thick are firmly cemented together by iron oxide of very dark, almost black color. The size of the gravels varies from the size of a wren's egg to that of a hen egg, averaging about $1\frac{1}{2}$ inches in diameter.

This is a magnificent pit, and can furnish thousands of car loads of gravel. On account of its firmly cemented condition much of the gravel has had to be crushed, and hence led to the abandonment of the pit. With the increase in the demand for gravel the pit will undoubtedly eventually be reopened.

The hills in the vicinity of the Rosetta pit are largely composed of gravel beds, and with the extension of the original pit others may be opened.

In Jefferson County extensive gravel deposits occur within four or five miles of the Y. & M. V. Railroad, but so far these gravels have been opened only to a limited extent for local use. On the Bullen place six miles southeast of Fayette, the broken surface reveals typical loess 10 to 15 feet thick underlaid by excellent brown chert gravels exposed to a depth of 25 feet. How much deeper this gravel extends was not determined, but perhaps 10 to 15 feet.

In southern Hinds County, west of Utica, and in the vicinity of the Big Black River, occur some notable outcrops of gravel exposed

25 feet on the Utica and Duke road, but owing to inaccessibility no development of the deposits has been attempted.

Southeast of Raymond within a mile and a half of the Natchez and Jackson Railroad two prominent hills show 25 feet of sand and gravel overlying gray sandstone of the Grand Gulf formation. The lower 10 feet of the hill is orange colored sand of perhaps Lafayette Age, above which is 15 feet of brown chert pebbles. The bulk of both hills is of the chert gravel of good quality, with considerable sand intermixed, making the material a good basis for concrete. The deposit is confined to the two conical hills of small area, and, therefore, would be exhausted within a comparatively short while. However, we are told the hills overlooking Cooper's Wells, a few miles north, reveal large gravel deposits.

Important gravel deposits occur in Franklin County near McNair and Hamburg on the Y. & M. V. Railroad. These are of the same character with the gravels of the western part of the state generally, and are of good grade, both for road and street paving and for concrete. Pits have been opened for railroad use.

Bordering the lowlands of the Delta north of Vicksburg are numerous gravel deposits of similar quality to those described as occurring in South Mississippi. At Yazoo City beds of excellent gravel have been exposed in the edge of the bluffs. The quality is good, the gravel being clean, as if washed, with a slight admixture of coarse sand, but the deposits are not more than 5 to 10 feet thick. The overburden consists of 40 to 50 feet of loess silt, so that more than limited development hardly seems possible.

At Charleston, Batesville, Courtland, and in all the adjacent regions gravel deposits are continuous and generally of considerable thickness. In the vicinity of Batesville the deposits are very heavy and the gravel of excellent quality. The gravels extend eastward from Batesville a distance of nine miles, gradually thinning. At Sardis several gravel pits for local use have been opened. The gravel beds extend westward to the edge of the bluffs and for several miles east of the town. At the pits examined the overburden consists of 4 to 6 feet of red loam, and the gravel has not been penetrated the full depth of the deposit. In some of the pits the binding material between the gravels is red sandy clay; in other pits only coarse sand is mixed with the pebbles. None of the pits are systematically worked. The best pit is one and a half miles north of Sardis on the west side of the railroad. Here the overburden is 5 feet of loam, below which the

gravel has been penetrated an equal distance. The depth of the gravel bed has not been tested. This gravel is of medium size, one to one and a quarter inches in diameter, has a brown sandy loam cementing material, and in all respects is typical of the Bluff Hills gravel.

At Hernando, in DeSoto County, the streets are paved with chert gravel obtained from beds that outcrop all around the town. These deposits are continuous under all the hills westward all along to the Bluffs, and eastward as far as eight or ten miles. On the land of P. M. Black eight miles east of Hernando and two miles from Pleasant Hill the steep face of a hill reveals the Wilcox dark gray clays and lignite at the base overlaid by 35 feet of Lafayette sand and gravel, the gravel being about 10 feet in thickness next to the lignitic clay.

One of the most extensive deposits of gravel in the State is located at Olive Branch, in DeSoto County. This is one of the few gravel deposits in the western part of the State that has been opened for commercial shipments of gravel. This deposit is owned and operated by the DeSoto Gravel Company, with offices located in Memphis. This company owns 65 acres of gravel land near Olive Branch, the pit being located one mile southeast of the station.

The pit is perhaps the best equipped in the State. The breast of gravel opened to the steam shovel is 600 feet long and the overburden has been stripped back to a distance of 160 feet. The pit is opened in the face of a large hill, the vertical face of gravel above the tracks being 25 feet, and as the hill is penetrated the depth will become greater. A well sunk by the company at the base of the hill penetrated the gravel at a depth of 70 feet below the track level. The company has every facility for handling the output of the pit in large quantities. They have constructed two miles of main line of railroad track which intersects the Frisco Railroad at a point known as Gillespie Switch and three sidings of 1,500 feet each. A forty ton locomotive pulls cars to the pit for loading and delivers them loaded to the Frisco Railroad. The gravel is removed from the pit by means of a Thew Automatic Steam Shovel with a cutting capacity of 800 yards per day. Under ordinary conditions the company is able to load and ship 25 cars of gravel per day. A neat office and implement house is fitted up at the pit. The well before mentioned is sunk to a depth of 200 feet and furnishes an abundant supply of pure water, which is pumped up by a gasoline engine for the use of the machinery.

The gravel from this pit has been tested by the Department in Washington and pronounced equal in all respects to the best road-making gravel obtainable.

The material is of brown chert with a binder of reddish brown sandy clay, the clay being in sufficient quantity to cause the whole mass to set, as in the case of a sand clay road, and hold the gravel firmly in the bed. The size of the gravel will average that of a guinea egg, and is quite uniform.

As a road-making and paving material this gravel should command a ready market.