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CHARLES D. WALCOTT, DIRECTOR

SUMMARY

OF THE

UNDERGROUND-WATER RESOURCES OF MISSISSIPPI

BY

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SUMMARY OF THE UNDERGROUND-WATER RESOURCES OF MISSISSIPPI.

By A. F. Crider and L. C. Johnson.

INTRODUCTION.

GENERAL WATER CONDITIONS IN MISSISSIPPI.

The problem of obtaining potable water in sufficient quantities and at a minimum cost has long engaged the attention of scientific and practical men in both Europe and America. More recently the death of a large number of people from infectious diseases contracted by drinking contaminated surficial water has directed the attention of the general public to the necessity of seeking drinking water from some other source.

In the Gulf Coastal Plain, of which Mississippi is a part, conditions are favorable for reducing to a minimum the death rate caused by drinking impure and unwholesome water. A study of the geologic conditions of the State shows that there is a great thickness of unconsolidated sands interbedded with water-tight clays which dip slightly to the south and west and form large underground reservoirs for the accumulation of water. The State has a heavy annual rainfall, which enters the upturned edges of the open-textured sands, collects in these wide reservoirs, and thus becomes available as well water when the overlying strata are drilled through. Good deep-well water can be obtained over almost the entire State, and there are large areas in which under favorable conditions flowing wells are obtained. The dip of the strata is so regular and the water horizons are so numerous that the areas are small in which potable water can not be found at comparatively shallow depths.

In most of the localities having flowing wells the supply seems adequate for all demands so far made upon it. The low cost of drilling wells in the Gulf embayment has made it possible for even the poorest to have plenty of good water. Railroads, cotton mills, sawmills, canning factories, and various public works have found the deep-well water cheaper and better than surficial water. Along the southern coast in the rice area water for irrigation is in many places obtained from artesian wells.

FIELD WORK.

The field work for this report was done by Messrs. L. C. Johnson and A. F. Crider. Mr. Johnson has been engaged for a number of years in geologic work in Mississippi and Alabama for the Alabama Geological Survey, and later for the United States Geological Survey. The collection of well records in this report was to a great extent made by him. In the fall of 1904 Mr. Crider, under the supervision of Messrs. E. C. Eckel and M. L. Fuller, in charge of geology and water resources, respectively, collected further data on the geology and its relation to the underground waters of the State. The present report was prepared by Mr. Crider from the data obtained from these sources. Much valuable information was also obtained from owners of wells, drillers, and others interested in the work.

GEOGRAPHY.

Mississippi occupies the central position of the States bordering on the Gulf of Mexico, with Alabama and Florida to the east and Louisiana and Texas to the west. It has a total area of 46,810 square miles, with an extreme length from north to south of 330 miles and a maximum width of 188 miles. It has 85 miles of coast line on the Mississippi Sound and a water frontage of 500 miles on Mississippi River.

The southern third of the State is largely covered with a fine growth of long-leaf yellow pine, which is being rapidly removed for lumber. There is still much valuable hard wood and short-leaf pine in the northern portion of the State. Besides the large areas of virgin timber, much land in the State that was in cultivation before the civil war has since been abandoned and now bears second-growth timber of a poorer quality, consisting principally of short-leaf pine.

TOPOGRAPHY.

With the exception of a very small area in the northeast corner, the entire State of Mississippi lies in the Coastal Plain. There is a gentle slope southward and westward from the region of northern Mississippi, where the highest hills rise about 700 feet above sea level.

The larger streams, such as the Tombigbee on the east and the Mississippi on the west, have cut out large valleys and have worn them down almost to base-level. The smaller streams have been constantly cutting back from the larger until there are but few undrained interstream areas. The configuration of the State, therefore, has been greatly changed, so that it can be separated into distinct topographic subdivisions.

The prevailing unconsolidated material of the various geologic formations has affected the topography of the State but little. The rivers and smaller streams in many cases flow at right angles to the strike, thus cutting across the changing strata of the various formations.

Tennessee River hills.—The foothills of the Appalachian Plateau reach their southwestern terminus in the northeast corner of Mississippi, near Tennessee River. The streams flowing into the Tennessee are short and have a steep gradient. They have thus cut deep channels into the older Carboniferous rocks, which stand out as high cliffs and form the most picturesque scenery of the State.

The western side of the Tennessee River hills slopes more gently to the Tombigbee Valley. The elevation of the ridge between the Tennessee and the Tombigbee is 600 feet or more. The elevation of the river at Columbus is 146 feet above sea level. This gives a total descent of over 450 feet for the waters of the western slope of the Tennessee River hills.

Tombigbee Valley or Northeast Prairie.—The Tennessee River hills and the high ridge extending north and south from the town of Pontotoc were once continuous across the broad valley of the Tombigbee. There is still a line of highland connecting the hills of the northeast with the plateau of the central part of the State, as the following elevations will show: Iuka is 460 feet above sea level and to the south the hills rise still higher, forming the divide between Tombigbee River and the waters of the Tennessee and Hatchee. The towns of Booneville and Ripley are situated near the crest of the divide; the former is 532 feet, the latter 525 feet, above sea level. The broad valley of the Tombigbee, commonly known as the "black prairie," has an elevation ranging from 179 feet at Macon to 532 feet at Booneville. The Tombigbee Valley is, therefore, a broad spoon-shaped trough with a high rim on three sides.

North-central plateau.—The large area occupying the north-central part of the State is a plateau sloping gently westward and southward from the divide between the Tombigbee basin on the east and the Mississippi and Pearl River basins on the west. The region has been greatly dissected by streams which still have deep, narrow valleys.

The plateau ends very abruptly along its western border, which is distinctly marked by a line of hills or bluffs extending from Memphis, Tenn., to Vicksburg, Miss., along the eastern rim of the Yazoo Delta. The bluffs stand 200 feet or more above the low-lying delta to the west. The difference in elevation of the Yazoo Delta and the central plateau to the east has caused the streams in central Mississippi to cut the bottoms of their channels more rapidly than they have widened their valleys.

The divide between the waters of the Tombigbee and Hatchee basins, which extends westward from the southern part of Tishomingo County to Ripley, continues unbroken with a gentle westward slope through central Tippah, northern Marshall, and De Soto counties almost to Mississippi River. The highest known elevation along this divide is near the town of Holly Springs, where the Illinois Central Railroad reaches 625 feet above sea level. The elevation of Olive Branch, in eastern De Soto County, is 421 feet, and near Horn Lake, which is but 12 miles from the Mississippi, the elevation is 340 feet.

Extending north and south, or at right angles to the east-west divide, is the Pontotoc divide, which separates the waters of the Tombigbee basin from those of the Mississippi, Pearl, Leaf, and Chickasawhay rivers. The Mobile, Jackson and Kansas City Railroad follows the ridge from Pontotoc to Louisville. Here the ridge turns southeast and passes into Alabama at the southern border of Lauderdale County. This divide has a general elevation throughout the State of about 500 feet.

Yazoo Delta.—The vast alluvial bottom known as the Yazoo Delta contains over 6,000 square miles lying between Mississippi River and the line of hills extending from Memphis through Batesville and Yazoo to Vicksburg. South of Vicksburg the Mississippi has a sharp wall on the east bank and a broad valley on the Louisiana side.

There is but little relief over the entire delta area. The larger streams, such as the Yazoo, Coldwater, Tallahatchie, Sunflower, and the Mississippi on the western boundary, have built up their banks by continual deposition so that the highest elevations are near the rivers, and there are gentle slopes to the interstream areas. When the Mississippi overflows the delta the banks of the larger streams are the last to be submerged.

There is a gradual slope southward from the Tennessee boundary, at an elevation of 217 feet, to Vicksburg, which is 94 feet above sea level. An east-west line from Greenwood to Greenville shows very little variation in the three known elevations. That at Greenwood is 143 feet, while the towns of Leland and Greenville are each 125 feet above sea level. This shows a very slight westward slope.

Jackson prairies.—Between the roughly carved region of the north-central plateau and the long-leaf-pine hills to the south is a belt of country known as the Jackson or central prairies. Its extent coincides with the area underlain by the Jackson formation, which is described on page 10.

The surface is more rolling than that of the regions to the north and south. Between Pearl River southeast of Canton and the town of Vosburg are large areas of level prairies covering hundreds of square miles. The streams on the north side of this belt as far east as Newton flow north and northwest to the Pearl; the streams on the south side flow to Strong, Leaf, and Chickasawhay rivers.

The elevation along the crest of the divide ranges from 426 feet at Vosburg to 475 feet at Forest. There is a gentle southward slope of less than 2 feet per mile from Louisville, which is 552 feet above sea level, to the Jackson prairies. The western third of the Jackson prairies is much lower than the region to the east. This is due to the valleys of Pearl and Big Black rivers. These rivers opposite Canton approach within 16 miles of each other, but the Big Black flows at a much lower elevation.

Long-leaf-pine hills.—The region from the Jackson prairies to the Gulf presents a diversity of topographic features. In many particulars it is analogous to the north-central plateau. The highest elevations rise more than 500 feet above sea level. The largest streams flow in very narrow valleys and are but little above sea level. The smaller streams are short and have steep gradients.

The interstream areas west of Pearl River have a maximum height of perhaps 600 feet. The Illinois Central Railroad from Beechgrove to Magnolia has many points above 425 feet in elevation, and reaches a maximum of 487 feet 5 miles north of Hazlehurst. This high plateau extends westward to within 10 to 15 miles of Mississippi River.

The region east of Pearl River is much lower except a small area south of Brandon, in southern Rankin and Simpson counties. Chickasawhay, Leaf, and Pascagoula rivers are but little above sea level, while the areas between have a maximum elevation of only 350 feet.

GENERAL GEOLOGY.

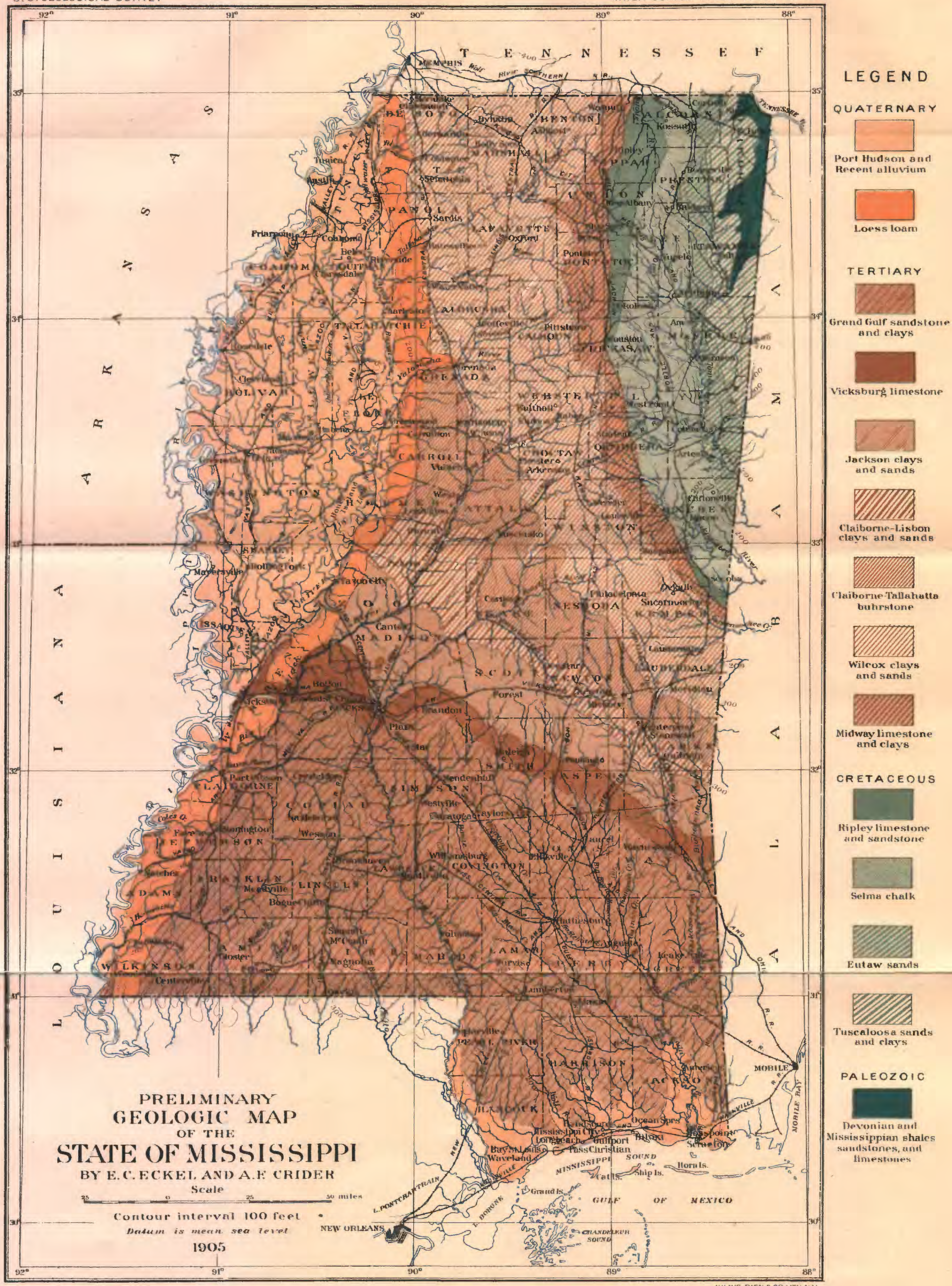
STRATIGRAPHY.

Though the geologic structure of Mississippi is very simple, the details of the stratigraphy are hard to make out. This is due largely to the extent to which the underlying rocks are covered by the more recent deposits, such as the alluvium and the "orange sand" or Lafayette formation.

The older rocks of the State represented by the Devonian and Carboniferous form the old sea floor, on which at a much later period the more unconsolidated beds belonging to the Cretaceous were laid down. The older rocks underlie the entire State, but come to the surface only in the northeast corner along Tennessee River.

The newer rocks outcrop south and west of this older mass in successive, roughly parallel bands. All dip slightly to the southwest, so that if an observer should start in Tishomingo County and travel through the State either south or west he would find himself continually passing over newer and newer series of rocks, until he finally reached the very recent alluvial deposits which fringe the Gulf and Mississippi River. The newer rocks, overlapping the older in the northeast, cover them to a greater and greater depth to the west and south. At the town of Corinth the hard rocks were struck at a depth of 450 feet from the surface, but, so far as known, no wells west or south of this have entered the hard Paleozoic rocks.

The Cretaceous and Tertiary sediments were deposited in a vast trough comprising the present States of Mississippi, western Tennessee and Kentucky, and southern Illinois on the east side; and southeastern Missouri, eastern Arkansas, Louisiana, and southeastern Texas on the west. To the east, north, and west of the embayment was higher land, which was worn down by erosion and from which material was carried by the streams and deposited in the trough-like embayment. Thus we have a series of strata dipping to the south and west on the east side of the embayment and to the east and south on the west side. The fine artesian-water basin in this region is due to the sandy, unconsolidated character of the sediments and the gentle slope of the sea floor on which they were deposited.


PRELIMINARY
GEOLOGIC MAP
OF THE
STATE OF MISSISSIPPI
BY E. C. ECKEL AND A. F. CRIDER
Scale
25 0 25 50 miles
Contour interval 100 feet
Datum is mean sea level
1905
LEGEND
QUATERNARY
Port Hudson and Recent alluvium
Loess loam
TERTIARY
Grand Gulf sandstone and clays
Vicksburg limestone
Jackson clays and sands
Claiborne-Lisbon clays and sands
Claiborne-Tallahatta buhrstone
Wilcox clays and sands
Midway limestone and clays
CRETACEOUS
Ripley limestone and sandstone
Selma chalk
Eutaw sands
Tuscaloosa sands and clays
PALEOZOIC
Devonian and Mississippian shales sandstones, and limestones
T E N N E S S E E
A R K A N S A S
L O U I S I A N A
A L A B A M A
GULF OF MEXICO
NEW ORLEANS
MOBILE
MEMPHIS
MOBILE BAY
CHANDELEUR SOUND
L. PONTCHARTRAIN
92°
91°
90°
89°
88°
35°
34°
33°
32°
31°
30°

The following section shows the geologic groups which are exposed in Mississippi and the relation of one group to another, the newest formations being at the top of the table and the oldest at the bottom:

General geologic section of Mississippi.

System.	Series.	Formation.	Water supply.
Quaternary		Recent alluvium. Sands, silts, and loam.	Large supply of unwholesome water.
		Yellow loam. Surface loam or brick clays of northwestern Mississippi.	Little or no water.
		Fossiliferous loess. Gray to buff-colored calcareous silt, containing land shells.	
		Port Hudson. Greenish to bluish clays, with interbedded sands. Calcareous concretions in lowest members.	Plenty of soft but unwholesome water.
		Lafayette. Red to yellow sands and iron-stained pebbles. Sands in places containing large amount of clay.	Good, wholesome, soft water. Source of shallow wells and springs in north-central and southern Mississippi.
Tertiary	Miocene?	Grand Gulf. Gray aluminous sandstones, interbedded with white to gray plastic clays in northwest; darker-colored clays containing lignitized wood and vegetable matter in southeast.	Source of flowing and nonflowing wells and numerous mineral springs.
	Miocene	Pascagoula. Calcareous sands, containing numerous fossils.	Probable source of flowing wells along the Gulf coast.
	Oligocene	Vicksburg. White, yellow, and blue crystalline limestone, interbedded with thin layers of indurated calcareous clay.	Little or no water.
	Eocene	Jackson. Gray calcareous clays, lignitic clays with gray siliceous sands, and some greensand.	Small amount of highly mineralized water.
		Claiborne group. Lisbon formation. Calcareous clays and greensands.	Little or no water.
		Claiborne group. Tallahatta buhrstone. Aluminous and quartzitic sandstones, greensands, and clay stones.	Plenty of water, which is sometimes highly mineralized. Source of deep flowing and nonflowing wells in the central and southern parts of the Yazoo Delta; also in Clarke County.
		Wilcox. Highly stratified sands and clays of various colors, with some beds of greensand marl.	Large supplies of soft water. Source of deep-well waters in the northern area of the Yazoo Delta. Water frequently mineralized.
		Midway group. Porters Creek. Gray aluminous clays.	Little or no water.
		Midway group. Clayton. Limestone, sands, and clays.	
Cretaceous		Ripley. Limestones, sandstones, and clays.	Plenty of wholesome water. Source of flowing wells in Pontotoc and Union counties.
		Selma chalk. White chalky limestone and blue calcareous clays.	Occasional springs of hard water.
		Eutaw. Siliceous sands and clays, with some greensand.	Water plentiful. Source of flowing and nonflowing wells over Selma chalk area. Water frequently impregnated with iron.
		Tuscaloosa. Variegated sands and clays.	
Carboniferous		Sandstone, limestone, and clays.	Numerous fresh-water springs; wells uncertain.
		Limestone and chert.	
		Siliceous chert.	
Devonian		Dark limestone and shale	Little or no water.

DESCRIPTION OF FORMATIONS.

DEVONIAN.

The lowest rocks found in the State consist of a series of dark-blue limestones, thinly bedded fine-grained sandstones, and shales representing the Devonian. The lowest visible strata are a series of beds of dark-blue limestone 45 to 50 feet thick, above which come 10 feet or more of highly siliceous chert, which has weathered into a sponge-like mass and contains numerous fossils. These Messrs. Schuchert and Kindle have determined as equivalent to the "New Scotland" beds, which lie at the base of the Devonian in New York. The fossiliferous cherty layer is overlain by 75 to 80 feet of black, and in places blue, shale containing more or less iron pyrite.

The Devonian rocks are of no importance as water carriers, but they act as an impenetrable barrier to the surficial waters and their line of outcrop is marked by numerous springs. The outcrop, which is limited in this State, forms the bed rock and steep cliffs along the west bank of Tennessee River and can be traced for a short distance along Yellow Creek, Indian Creek, and other small streams flowing into the Tennessee. The tops of the hills between these streams are covered with Cretaceous sediments. The shaly material which was struck in the Corinth well perhaps belongs to the dark-colored shales coming above the fossiliferous horizon along Yellow Creek.

CARBONIFEROUS.

Above the Devonian lies the Mississippian (Lower Carboniferous) series of limestones, sandstones, and shales. The thickness of these beds is not known, but it is perhaps 700 or 800 feet. They are but little disturbed and have a perceptible dip to the south and west. The Carboniferous represents the southwestern extremity of the southern Appalachian Plateau, whose southern and western slopes are overlapped by the younger formations.

The heavy-bedded limestones in many places interbedded with shales, cause numerous springs along the watercourses. The coarse-grained sandstone at the top of the Carboniferous forms a reservoir for the accumulation of water, but in numerous places it has been cut through to the underlying limestone, and excellent springs are found at its base. Where there is no leakage, good water is obtained by drilling through the sandstone.

In the Carboniferous area good water is obtained at the base of the overlapping surficial red and yellow sands and from numerous springs, so that very little attention has been given to the deeper waters.

The area of the Carboniferous outcrop is somewhat greater than that of the Devonian, but it is likewise confined to the stream valleys in the eastern and southern portions of Tishomingo County, in southeastern Prentiss, and in northeastern Itawamba County. Over a large area along the eastern border of the Lower Cretaceous the Carboniferous lies near the surface, but the westward dip of the old sea floor and the constantly increasing depth of the Cretaceous to the west soon carry the Carboniferous strata hundreds of feet below the surface.

CRETACEOUS.

TUSCALOOSA FORMATION.

Between the uppermost member of the Carboniferous and the next overlying formation met with in northeastern Mississippi there is a marked unconformity. This overlapping formation is well shown near Tuscaloosa, Ala., from which it has been named. In the Tuscaloosa formation and in those of still younger age the important water horizons of the State are found. In Tennessee the Tuscaloosa and the overlying Eutaw have been grouped together and described under the name of "Coffee" sands.

In its lower portion the Tuscaloosa is composed of various colored clays, lignite, and lignitic clays; in the upper part are variegated, cross-bedded sands and sandy clays. The clays at the base are so compact and free from sand that they serve to retain or check the descending waters.

A. OUTCROP OF SELMA CHALK, THE CAP ROCK OF THE WATER-BEARING EUTAW SANDS.

B. TALLAHATTA BUHRSTONE CAP ROCK, OVERLYING LOOSE SILICEOUS SAND.

The sands of the upper portion supply the water of this formation. They do not extend in one continuous bed from the top to the bottom, but there are various irregular horizons throughout the formation, which supply water. The irregularity is due to the noncontinuous beds of clay, which are not persistent throughout the formation.

The thickness of the formation is estimated from well borings in western Alabama to be 1,000 feet, of which 300 to 400 feet or more are the compact clays at the base. In wells at Corinth, Miss., the hard rocks of the old sea floor were encountered at 450 feet. At a depth of 150 feet the upper sands of the Tuscaloosa were found, so that the entire thickness of the formation in the north is 300 feet.

The area occupied by the formation is a long, narrow strip east of a meandering line extending north of the town of Columbus to the Tennessee line, including the northeastern portion of Lowndes, the eastern half of Monroe, and a small strip in the eastern part of Prentiss and Alcorn counties, and overlapping the Carboniferous and Devonian in Tishomingo County.

EUTAW FORMATION.

Immediately overlying the Tuscaloosa is the Eutaw formation, which is typically exposed at Eutaw, Ala. The lowest division of the Eutaw is composed of nonfossiliferous, highly micaceous sands and is distinguished with difficulty from the underlying sands of the Tuscaloosa. In the upper portion of the formation the sands become lighter in color, increase in lime carbonate, and are more or less fossiliferous. This marks the beginning of the marine conditions which culminated in the Midway.

The formation is about 300 feet thick near the Alabama line and gradually becomes thinner to the north. The Cox well at Corinth is reported to have struck the Eutaw water-bearing sands at a depth of 90 feet.

The area underlain by the Eutaw formation consists of a narrow belt of country, 5 to 12 miles wide, lying just west of the area of the Tuscaloosa formation. Under the heading "Water horizons of Mississippi" the Tuscaloosa and Eutaw have been taken together as forming one water horizon. These formations are the most important water bearers in northeastern Mississippi, and over large areas west of their outcrop these form the only source of well water.

SELMA CHALK.

The subdivision immediately overlying the Eutaw formation is the Selma chalk or "rotten limestone." In general appearance the Selma formation is a mass of loosely cemented lime carbonate (Pl. II, *A*); but it can be separated into three divisions—(1) the sandy or transition beds at the base, (2) the "blue rock" or unweathered portion, and (3) the "rotten limestone" or chalk near the surface.

The lowest division contains a great amount of free sand, which was washed into the Selma sea from the older land surface to the east. This forms the transition beds from the extreme sandy portion of the Eutaw to the purer lime carbonate of the upper Selma.

The "blue rock" or middle portion contains a large amount of clay, and when freshly exposed is of a bluish color. The clay, which renders the rock impervious, confines the water in the Eutaw sands below, and thus makes it possible to have artesian wells over the eastern Selma area. The clayey portion contains the only suitable material for holding cistern water.

The uppermost division contains a greater amount of lime carbonate and much less clay than the blue rock. It weathers along the rapidly cutting streams into white chalk bluffs, which are exposed along the western border of the outcrop. The porous chalk of the upper subdivision absorbs a great amount of water, and streams soon dry up after a rain.

The thickness of the Selma, as determined by many deep wells throughout the region, is found to vary from about 350 feet near the Tennessee line to 1,000 feet at Starkville. In estimating the thickness of the formation a small allowance must be made for the westward dip of 35 feet to the mile in the south and 10 to 15 feet in the north.

The surface of the outcropping Selma is a level or rolling prairie well adapted to agriculture. It embraces the larger part of Noxubee, western Lowndes, eastern Oktibbeha, the larger part of Clay, western Monroe, the eastern half of Chickasaw, almost all of Lee, western Prentiss, and central Alcorn counties. The west line of outcrop can be traced approximately through the towns of Scooba and Flatwood, and 3 miles west of Starkville to Houston. From here the line bends more to the east, through Troy, Blue Springs, Graham, and Antioch, and 2 miles west of Kossuth to the Tennessee line.

RIPLEY FORMATION.

Above the Selma chalk is the uppermost division of the Cretaceous, which has been called the Ripley formation, and which is made up of three substances. Dark-blue marl, containing abundant well-preserved fossils, occupies the upper part, and thinly bedded marly clays, alternating with sandy limestone, the lower part. The limestones are sufficiently porous to hold water. They come to the surface along the eastern border of the Ripley outcrop, and, with a westward dip of the strata greater than the slope of the surface, a small artesian basin is formed along the headwaters of Tallahatchie River.

The thickness of the formation, estimated by the width of the outcrop with a westward dip of 15 feet to the mile, is at a maximum, 280 feet.

The change from the rolling prairie surface of the Selma to the steep hills of the Ripley is very noticeable. The Ripley formation occupies a much smaller area than the Selma chalk, being widest at the north and wedging out entirely in Chickasaw County, at the town of Houston. From here south to the Alabama border the high hills of the Ripley as found in Tippah, Union, and Pontotoc counties are entirely wanting, except in a small area near the Alabama border. It is well exposed in Alabama, but wedges out in Kemper County, Miss., near the town of Shuqualak. From here to Houston the level "Flatwoods" of the Midway border on the prairie lands of the Selma chalk.

TERTIARY.

MIDWAY GROUP.

Clayton limestone.—The lowest division of the Tertiary is represented in Mississippi by a series of hard crystalline limestones, known as the Clayton limestone, and calcareous sandy marls. The limestone of this formation was referred by Hilgard to the Ripley, but later investigation by Harris and others has, on paleontologic evidence, placed it in the Midway.

The limestone has a maximum thickness of 20 feet near the town of Ripley. It is overlain by 20 to 30 feet of reddish to yellow sandy marl containing lime carbonate, and is slightly fossiliferous. The reddish color is due to a large amount of iron oxide. The color of these sands is very similar to that of the Lafayette, which is described on page 12.

The Clayton outcrop forms a narrow strip of territory from 2 to 6 miles wide, lying just west of the Ripley area. The line of the Mobile, Jackson and Kansas City Railroad follows the outcrop approximately from Middleton, Tenn., to Houston, Miss. From here the outcrop turns in a southeasterly direction west of Starkville and Macon and passes into Alabama southeast of Scooba.

No doubt the sands of the upper division are water bearing, but so far no wells to the west have penetrated the Clayton.

Porters Creek clay.—In Tennessee the name Porters Creek has been given to the clays immediately overlying the Clayton limestone. The calcareous sandy marl of the upper Clayton is overlain by 75 to 100 feet of gray nonfossiliferous clay, which forms the well-known "Flatwoods" area, extending from Tennessee into Alabama. This formation produces very stiff clay soils which are little used in the State for agricultural purposes. Roads through the "Flatwoods" often become impassable during the rainy season.

The Porters Creek outcrop occupies a narrow strip of country extending from Middleton, Tenn., into the State of Alabama, and has a width of 2 to 12 miles. In the north it is hemmed in between the Ripley hills on the east and the Wilcox plateau on the west. South of Maben the range of hills on the east border of the Wilcox formation rises 100 feet or more above the Porters Creek, and is more distinct than the line between the Porters Creek and the Clayton limestone. The western border is easily traceable from 4 miles east of Maben due south through Oktibbeha County; here the line turns in a more southeasterly direction, running through Shuqualak and Scooba into Alabama.

The Porters Creek clay marks an important horizon between the waters of the Ripley and Wilcox horizons. The rainfall entering the outcropping sands of the Ripley follows these beds, which dip gently to the west. The overlying Porters Creek clay prevents the water from rising, and it is thus confined and given pressure as the reservoir becomes full.

WILCOX FORMATION.

The important division of the Tertiary known as the Wilcox formation occupies a large area of northern Mississippi. It was originally named the Lignitic by Hilgard, and Safford, State geologist of Tennessee, termed it the La Grange group.

The term "Lignitic" as used by Hilgard has been objectionable because it is not a locality name. As used by Safford the term "La Grange" included the present Lafayette and portions of the Cretaceous, so it has likewise been discarded. The present name, Wilcox, was first given in some unpublished work by Eugene A. Smith, State geologist of Alabama, for the reason that typical strata of the former Lignitic of Hilgard are exposed at Wilcox, Ala. The name has been adopted by the United States Geological Survey as the formation name to include the complex mass of sands, clays, lignites, marls, etc., between the Porters Creek clays below and the Tallahatta buhrstone above.

Owing to its more or less sandy character throughout, the Wilcox forms the most important water horizon of northern Mississippi. The coarse-grained, unconsolidated sand beds are often interbedded with seams of lignite and white and chocolate-colored clays. The clays of the upper division, as at Grenada, are very dark and may properly be called shale. In the eastern half of the area loosely bedded sands predominate. The western portion, which is a series of irregularly cross-bedded sands and sandy clays, is separated from the eastern by a more or less regular line of white and chocolate-colored clays, which are used for making stoneware.

The thickness of the group is estimated from the width of the outcrop to be 750 to 800 feet. The deep well at Memphis is reported to have passed through the Wilcox at a depth of 963 feet.

In Alabama, Smith has divided the "Lignitic," the equivalent of the Wilcox, into six members. Each contains one or more marl beds from which distinguishing fossils are obtained. He includes in the "Lignitic" the Porters Creek clays, which in Mississippi are mapped with the Midway.

The Wilcox covers the largest territory of any formation in northern Mississippi. It occupies the entire area lying between the Porters Creek outcrop and the bluffs on the eastern rim of the Yazoo Delta as far south as Grenada. The west edge south of Grenada is a line extending southeast 6 miles east of Winona, west of Philadelphia, and southwest of Meridian.

The entire Wilcox group is very important as a water-bearing formation. The numerous beds of sand interbedded with clays form various water horizons throughout the formation. The shallow artesian wells at Batesville and Coffeeville, begun below the yellow loam and Lafayette, show that there are beds of clay in the upper division of the Wilcox sufficiently persistent and compact to confine the water below the clay and to form artesian basins in the upper Wilcox.

CLAIBORNE GROUP.

The Claiborne is divisible on lithologic grounds into two distinct formations. The lower of these is the Tallahatta buhrstone, or "siliceous Claiborne;" the upper includes the Lisbon beds, or "calcareous Claiborne."

Tallahatta buhrstone.—This formation, called "siliceous Claiborne" by Hilgard, consists chiefly of glauconitic coarse-grained micaceous sandstone, siliceous and aluminous clay stones, and a white siliceous sandstone that is almost quartzite. The estimated thickness is 350 feet.

The formation outcrops in a belt of territory between the Wilcox and Lisbon beds, and varies in width from 10 miles in northeastern Clarke County to 30 miles in Leake and Winston counties. The eastern line of outcrop is traceable from the Alabama line 4 miles south of Hurricane Creek post-office to Eastville; thence it swings southwest nearly to Sterling, south of Meridian; thence it bends northwest past Battlefield, Philadelphia, Plattsburg, Hinze, and French Camp, 6 miles east of Winona, and west of Grenada. No trace of the Tallahatta has been found north of Yalobusha River.

For the eastern part of the delta and the central portion of the State lying south of the Tallahatta outcrop, this formation forms a very important water horizon. The extensive area underlain by the formation and the porous texture of its materials make it well suited for absorbing a large amount of rainfall. The water-tight clays at the base of the overlying formation confine the water in the Tallahatta buhrstone.

Pl. II, *B*, shows a hard cap rock of sandstone at the top of the section, with loose siliceous sand immediately underlying it. Over extensive areas in the Yazoo bottom flowing wells are obtained when the drill passes through the hard layer of sandstone and enters the sands below. The ledge of sandstone, which varies in thickness from 12 to 30 inches, is very hard, in places almost a quartzite, and often requires several days' drilling to pass through it.

Lisbon formation.—Above the Tallahatta is a series of beds which Hilgard called "calcareous Claiborne" and which will be termed the Lisbon formation. The series is about 150 feet thick, and is composed of calcareous sands and laminated and lignitic clays. The character of the surface is little affected by the Lisbon, which is almost everywhere overlain by the Lafayette.

In Alabama the area underlain by this formation is very limited in extent, but in Mississippi it widens out and occupies the territory from southeastern Clarke to southern Carroll County, varying from 5 to 25 miles in width.

The thick mantle of Lafayette covering the Lisbon area furnishes plenty of good water, and the water-bearing horizons of the Lisbon have therefore not been developed.

JACKSON FORMATION.

In Alabama the Jackson and the succeeding formation, the Vicksburg, have been classed together under the name of St. Stevens. In Mississippi, however, they can usually be separated very readily and will be treated as two distinct formations.

The essential materials of the Jackson group are gray calcareous and lignitic clays and sands. The outcrop occupies a belt of country 10 to 30 miles wide, extending southeast and northwest across the State from Yazoo to the Alabama line north of Waynesboro. The area is known as the "central prairie."

There are no continuous water horizons in the lower or middle Jackson. It is usually barren of water, and when found the water is very impotable. Wells in this region obtain their water either from the base of the Lafayette or from the upper member of the Tallahatta buhrstone. Flowing wells are obtained along the lower streams.

The Jackson has usually been described as "marls" and clays, but recent investigations along the line of contact with the Vicksburg have shown that there are between 50 and 75 feet of yellow, gray, or white siliceous sand at the top of the Jackson. Whether from a paleontologic standpoint this should be considered Jackson or Vicksburg we are unable to say, since no fossils have been found in the sands. They are regularly stratified, showing that they were deposited in a quiet sea with little or no current. In places near the surface the sands are slightly cemented with iron oxide, causing some layers to resist erosion more than others.

Pl. III, *A*, represents the highly stratified character of the siliceous white to gray sands of the uppermost member of the Jackson formation. These sands, which are very porous, are exposed through erosion over large areas in Mississippi and absorb large amounts of water, the water table in such cases very nearly reaching the surface (Pl. III, *B*).

A. JACKSON SANDS, SHOWING CHARACTER OF MATERIAL, AND EROSION AND CATCHMENT CONDITIONS.

B. UPPER PART OF JACKSON FORMATION, SHOWING WHITE OR GRAY SILICEOUS SAND PHASE.

This is the only horizon of the Jackson which may become of any importance as a water-bearer. South of its outcrop there are no deep wells which are known to derive their waters from this horizon, so that its importance in this respect is not known.

VICKSBURG LIMESTONE.

This formation, first studied by Conrad at Vicksburg, occupies a very limited area south of the Jackson. It consists of crystalline limestone in beds varying from 1 inch to 3 feet in thickness, alternating with sandy calcareous strata of marl of about the same thickness. There is a marked difference in the appearance of the different beds of limestone. Those near the surface are soft and yellow, while the more compact beds unaffected by surface weathering are blue. The rapidity with which the limestone breaks down under the action of weathering agents makes it unsuited for building stone or road material. The Vicksburg is of no importance as a water-bearing formation.

PASCAGOULA FORMATION.

E. A. Smith has distinguished along Pascagoula River in Mississippi a series of calcareous sands bearing a Miocene fauna overlying the Vicksburg limestone and underlying the great mass of lignitic sands and clays of the Grand Gulf. He has given it the name Pascagoula formation. No other outcrops have as yet been found in the State, but deep-well borings along the Gulf coast have brought up calcareous sands containing fossils which L. C. Johnson refers to the Pascagoula. It was at first thought that the Pascagoula was younger than the Grand Gulf, or doubtless a fossiliferous horizon in it, but more recent investigation has shown that the Pascagoula clearly underlies the Grand Gulf.

At the type locality of the Pascagoula formation, as well as at Mobile and points along the Gulf in Mississippi, the Pascagoula beds are overlain by Grand Gulf beds; but further field work will be required before the relation of the two series (Grand Gulf and Pascagoula) in other areas can be stated with certainty. Such later work may require a redefinition of the term Grand Gulf. Owing to the limited area of outcrop the formation is not shown on the map. The Pascagoula furnishes an important source of fine artesian water along the coast.

GRAND GULF FORMATION.

The Grand Gulf formation is used in the sense in which it was originally defined by Hilgard. It is, therefore, not a homogeneous series of beds, but may include formations of different age. It is certain, however, that everything here included in the Grand Gulf is newer than the Vicksburg limestone and older than the Lafayette or "orange sand" formation.

The Grand Gulf is made up almost entirely of sandstones and clays. The sandstones are usually but slightly cemented and are made up of sharp grains of silica, with more or less alumina and iron pyrites. The color varies from a pure white to a rusty yellow, the latter resulting from the oxidation of the sulphide of iron. These sandstones are especially common in the northwestern part of the area underlain by the Grand Gulf—that is, northwest of a line drawn from Fort Adams to Raleigh. Southeast of this line sandstones are very rare. Elsewhere the formation consists of bluish to black clays, shales, and unconsolidated sands. The thickness of the Grand Gulf, as ascertained from deep-well borings, is 750 to 800 feet.

The Grand Gulf underlies most of that part of Mississippi south of a line drawn as follows: Starting at the river a few miles south of Vicksburg it runs parallel to and a mile or so south of the Alabama and Vicksburg Railroad, and passes a short distance north of Raymond. Here the boundary line bends rather abruptly southeast, crossing the Illinois Central Railroad between Terry and Byram. It then turns northeast passing through Monterey to Brandon, at which point it finally assumes a southeasterly direction through Daniel, Raleigh, Vosberg, and Waynesboro into Alabama. All the State south of this line is occupied by the Grand Gulf group (except the narrow belt of Port Hudson clays which border the Gulf coast in Hancock, Harrison, and Jackson counties and are described on page 13.)

The area along the Mississippi from Fort Adams nearly to Vicksburg, and in Lincoln, Copiah, Hinds, Simpson, and Rankin counties, contains the only outcrops of the sandstones. In these localities it alternates with the bluish-tinted clays. At Raymond and Star the sandstones attain a thickness of 15 feet and appear near the summit of the hills, with thinner strata below alternating with semiplastic clays.

The sandstones are wanting south and east of the line mentioned above, and the formation is essentially indurated, laminated sands and clays of various characters, from the white plastic clays to those containing lignitized tree trunks. Beds of lignite are also of frequent occurrence.

Many of the fine artesian wells along the Gulf derive their waters from the Grand Gulf formation. In the region of Hattiesburg and Columbia flowing wells are obtained from its lower division.

LAFAYETTE FORMATION.

Resting unconformably upon all the underlying formations from the Grand Gulf to the Carboniferous is a thin veneering of the Lafayette formation. This is a fresh-water deposit, composed chiefly of dark-red to light-red, coarse, round-grained sand, which in places contains more or less clay and water-worn pebbles. It varies from a knife-edge to 50 feet or more in thickness. The latter thickness is very rare, and it is more often found to be less than 10 feet.

In Tishomingo and Itawamba counties the Lafayette contains large deposits of water-worn pebbles, gravel, flint, chert, and some quartz, extending in a north and south belt 5 to 10 miles wide. Another belt of similar material occurs along the eastern edge of the loess formation, in the counties of De Soto, Tate, Panola, and Yalobusha. The shape of the pebbles is somewhat different in this belt—those of the above-mentioned counties being worn into an oblong egg shape, while here they have a more rounded form; they also contain more quartz. Still another belt, which is practically a prolongation of the western belt, is found in the southern part of the State. The main line of the Illinois Central Railroad runs along the outcrop of the gravel beds from Jackson to the Louisiana border.

The Lafayette was deposited upon a deeply eroded surface of the older formations, which accounts in part for the irregularity in its thickness. Since the deposition of the Lafayette there has been a large amount of erosion, and in many places the whole formation has been removed. In the areas of the Selma chalk and the Porters Creek formation the Lafayette is practically absent. East of the Selma chalk area there is more or less of the Lafayette covering the Eutaw, Tuscaloosa, and Carboniferous. In northern Mississippi, particularly in Marshall and Lafayette counties, where the formation was first described and named, the Lafayette, when present at all, is only a few feet thick, but in many places it is wanting. It thickens to the south, reaching its maximum in southern Mississippi, where it is said to be 200 feet thick. No such thickness, however, was observed in the course of the present work.

In various localities in the State the iron in the Lafayette has cemented the Indian red sands and formed a ferruginous sandstone, which is often mistaken for pure limonite or brown hematite. These deposits are uniformly of very shallow depth, but may extend over considerable areas. The ferruginous sandstone is always formed immediately above a bed of clay or some material which checks the downward flow of water. The water passing through the Lafayette becomes saturated with iron oxide, and, on being checked at the base by the underlying clay, deposits the iron, which cements the sands into a compact mass. This mass is constantly increased by the addition of more iron from the iron-charged waters. Gradually the overlying material is worn away until the ferruginous sandstone is reached, which resists the action of erosion and often forms a scarp along the tops and sides of hills.

Where the Lafayette is thick enough it forms the source of a very desirable and easily accessible supply of potable water. The great amount of sand in the formation forms a natural filter. Many of the springs of the State issue from the base of the Lafayette, where it rests on a bed of water-tight clay, a lignite seam, or limestone.

QUATERNARY.

PORT HUDSON FORMATION.

The formation immediately above the Lafayette has been called the Port Hudson, from the typical exposure at Port Hudson, Miss. It is composed of clays, silts, and unconsolidated sands containing old cypress stumps representing different generations superimposed one upon another. The thickness of the formation, as determined from criteria obtained along the Gulf, is 100 to 125 feet.

The Port Hudson area occupies a narrow belt along the Mississippi south of Vicksburg, the low-lying belt of country between Yazoo and Mississippi rivers erroneously called the "delta," and a small area bordering on the Gulf of Mexico. There is a possibility that the so-called Port Hudson of the Yazoo Delta belongs to a much younger age than the Port Hudson farther south, but for the present it is all mapped as one formation. The vast body of land called the "delta" is but a few feet above the common high-water mark of Mississippi River, and was overflowed in times of very high water until as late as 1884. The investigations of Hilgard have shown that the formation was deposited in a fresh-water embayment during the slow depression of the continent at the close of Glacial time, and that it was not due to the successive overflows of the old Mississippi River.

As far east as Union County, along Tallahatchie River, old inhabitants say the bottom land has been elevated in their lifetime from 2 to 4 feet by successive overflows of the river, a fact easily proved by noting the difference in elevation of the surface on the outside and inside of hollow cypress stumps. The gradual elevation of the bed of the Mississippi in recent years and the vast alluvial deposits show that the Port Hudson formation may possibly be of river origin.

Water in large quantities may be obtained very near the surface over the entire area of the Yazoo Delta by simply driving down a pipe with a strainer attached at the lower end. The large amount of vegetable matter in the Port Hudson sediments causes a very unwholesome drinking water.

FOSSILIFEROUS LOESS.

East of the Mississippi, south of Vicksburg, for a width of 12 to 15 miles, and bordering the eastern limit of the Port Hudson north of this place, is the loess or "Bluff" formation. This is made up of a homogeneous, silty, calcareous loam containing a great number of land shells.

YELLOW LOAM.

Immediately overlying the loess and extending from 25 to 35 miles farther east than the typical loess is the formation which Hilgard has called the "yellow loam." This is an unstratified mass of sandy clay or loam, entirely void of fossils, and of a uniform pale-yellow to light-brown color. East of the calcareous-loess area it forms a thin covering over the Lafayette, when that is present, and has a maximum thickness in northwestern Mississippi of 25 feet. It is also present in the central and southern parts of the State, but is much thinner here than farther north.

RECENT ALLUVIUM.

The most recent strata of the State, occurring along the larger streams, particularly along the Mississippi, have been mapped with the Port Hudson formation.

UNDERGROUND-WATER RESOURCES.

SOURCE OF UNDERGROUND WATERS.

In a series of sands and clays, such as those of the Coastal Plain deposits of Mississippi, the deposition of which took place beneath the salt waters of the ocean, the ground waters are derived from two diverse sources. The salt waters encountered in certain of the deeper wells represent, in all probability, ocean waters which have been retained in the deposits since the accumulation of the latter beneath the sea, while the fresh waters encountered in all of the shallow and in a large proportion of the deep wells have been derived from the rainfall.

RAINFALL.

Mississippi has an average rainfall, according to the Weather Bureau, of about 51 inches, the precipitation varying from 49 inches at the northern edge of the State to 54 inches near

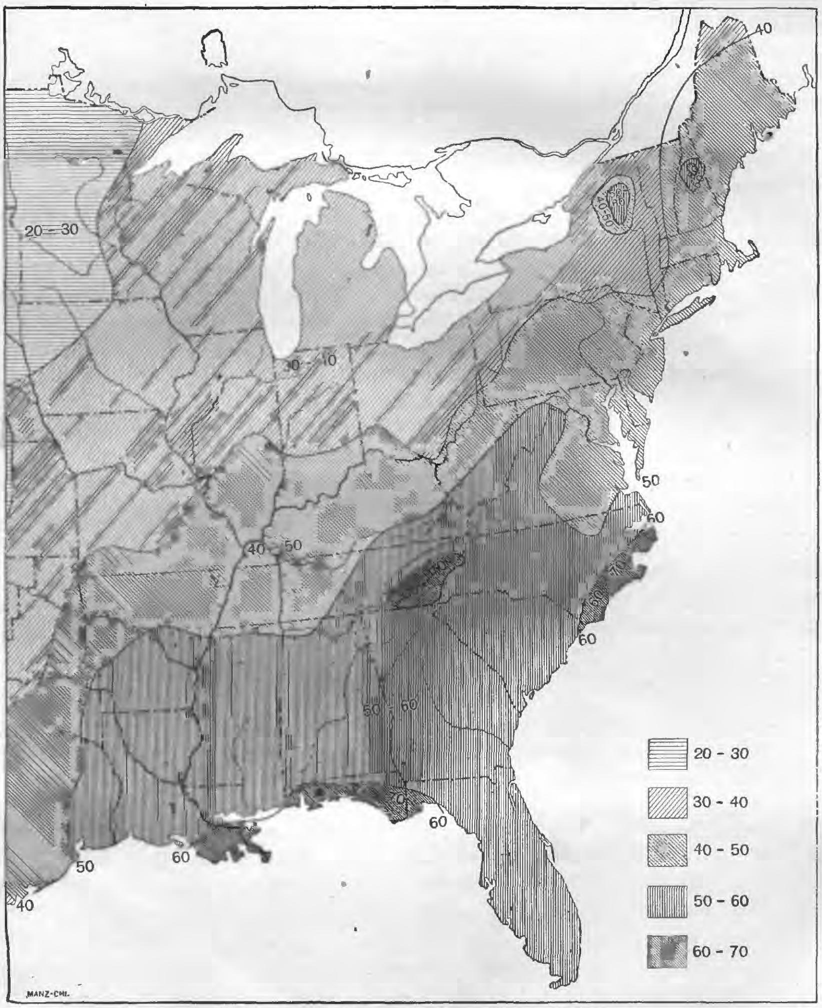


FIG. 1.—Rainfall map of eastern United States.

the coast. The greatest annual precipitation recorded in the State was 101.47 inches at Bay St. Louis in 1900, and the least, 22.49 inches, at Kosciusko in 1889. October and November are usually the dryest months of the year.

Not only does the rainfall vary in total amount from year to year, but the amount in a given district varies greatly. This fluctuation is so large that a rainfall map for a given year has little value. Unfortunately no map showing average precipitation in detail is available, but the general average rainfall for the State and its relation to adjacent areas is shown in fig. 1.

DISPOSAL OF RAINFALL.

The precipitation is taken up mainly in three ways—(1) by evaporation directly from the surface before the rain is absorbed, (2) by direct run-off of the water into the streams without its being first absorbed by the soil, and (3) by absorption into the ground.

A very large proportion, probably 40 to 50 per cent, of the water absorbed by the ground in Mississippi is returned again to the atmosphere by evaporation, either directly from the surface or through the vegetation with which the surface is covered. Of the remaining ground water it is estimated that 1 per cent or less is permanently taken up in chemical combination by the rocks. The rest joins the underground water body occupying the pores and crevices within the rocks and other materials. Where the conditions have been such that water could penetrate the rocks these have long since been filled to saturation up to drainage level, so that practically all the excess of ground water not removed by evaporation finds its way to the valleys and other low spots, where it forms springs or joins the streams by general seepage. The amount thus returned to the streams is a large proportion of the total run-off, the immediate run-off, or that portion of the flow which has never been absorbed by the soil, being estimated at from 5 per cent of the rainfall in the case of certain sandy districts to 33 per cent in an area where the rocks are of several diverse types. It is thought that in the entire State probably not more than 15 per cent is removed by the direct run-off.

Detailed observations of the relation of rainfall to run-off have been made in the Tombigbee and Yazoo River basins. In the former basin, north of Columbus, there was in 1903 a rainfall of 42.69 inches, while the run-off was 19.88 inches, of which 85 per cent, or 16.87 inches, is estimated to have passed through the soil before joining the streams. In a way this may be taken as representing the surplus ground water for the year of the computation. Reduced to gallons, this surplus amounts to about 458,000 gallons per acre. In the Yazoo basin the run-off was 17.41 out of 42.68 inches, the surplus computed in the same manner as above being 402,300 gallons per acre. When it is remembered that a well flowing 100 gallons a minute ranks as a large well, and that the surplus rainfall of every 130 acres would furnish such a well, the vast amount of available ground water, yielding approximately 5 wells to each square mile, or about 234,000 to the State, will be better understood.

DEPTH OF PENETRATION OF WATER.

Water penetrates downward through the pores of the rocks and through cracks, fissures, and other passages. Theoretically it can pass downward until the rock pressure becomes so great that there are no openings, a condition which is estimated to exist at a depth of about 6 miles. As a matter of fact, however, active circulation of ground water takes place mainly in stratified rocks, and then only within a relatively short distance of the surface, usually from 1,000 to 2,000 feet. It is commonly useless to expect unmineralized waters at greater depths.

CAPACITY OF MATERIALS TO HOLD WATER.

The amount of water which can be held by different materials varies greatly. That absorbed by some of the common rocks is shown in the following statement: [a]

Amount of water absorbed by some common rocks.

[In quarts per cubic foot.]

Granite	$\frac{1}{100}$– $\frac{1}{4}$
Limestone (dense)	$\frac{1}{4}$–$1\frac{1}{4}$
Dolomite (including porous limestones)	1– 5
Chalk	4– 8
Sandstone	2– 6
Sand	8–10
Clay	10–12

Rocks have the greatest absorptive power when the grains are of uniform size. Where there is a mixture of fine and coarse grains much less water is taken up. Unfortunately the amount which a given material will yield does not depend entirely on the amount which it contains. For instance, clay, though it has a high porosity, holds water with great tenacity and will yield but little to a well.

RATE OF PERCOLATION.

In general it may be said that the coarser the sand and the smaller the amount of clay the more rapid the rate of movement, but this also depends largely on other factors, such as pressure and temperature. With a given material nearly twice as much water will percolate through a stated area at a pressure of 20 pounds per square inch as will pass through it at 10 pounds. Likewise the percolation is nearly twice as rapid with the water at 100° F. as it is at 50° F.

GROUND-WATER DIVISIONS.

The earth's crust may be divided into three zones, according to the conditions of underground-water circulation: (1) The unsaturated zone, extending from the surface of the ground down to the upper surface of the ground-water body, or the "water table," as it is commonly termed; (2) the zone of shallow or, as they are frequently termed, "surface waters," extending from the level of the water table down to the first impervious stratum of considerable extent; and (3) the zone of deep-seated waters, or those lying below the first impervious stratum. The unsaturated zone may contain a considerable amount of water, but it is not stationary, being simply in transit from the surface downward to the water table, or surface of the zone of shallow waters. The zone of shallow waters as here defined is a unit, but the zone of deep-seated waters is not a unit, as there are in most cases several subdivisions, depending on the presence of impervious strata within the zone.

GROUND-WATER TABLE.

The water table in general shows a somewhat close agreement with the slope of the surface of the land, tending to flatness under plains and to inequalities, similar to those of the surface, in the hilly regions. The undulations of the water table, however, are less marked than those of the land surface, the water standing considerably below the top of the ground at the crests of the hills while it is practically at stream level in the valleys. The depth of the ground water below the surface depends on the rate of lateral percolation into the streams as compared with the rainfall. In the eastern United States the permanent ground-water level is seldom at a great depth below the surface, water being commonly obtained within 30 to 40 feet of the top of the ground in lands of moderate elevation, while in valleys supplies are often obtained at depths of 15 feet or less. In the arid regions, on the other hand, the ground-water level may be many hundred feet below the surface.

[a] Data furnished by M. L. Fuller.

A. GASOLINE PUMP AND METHOD OF ATTACHMENT.

B. APPARATUS FOR PUMPING BY HORSEPOWER.

Photograph by M. L. Fuller.

The relations of the ground-water table to the surface in a region of uneven topography are shown in fig. 2.

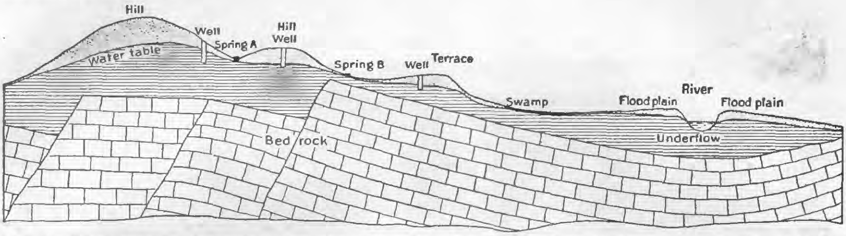


FIG. 2.—Ideal section through valley and hills, showing the position of the ground water and the undulations of the water table with reference to the surface of the ground and to bed rock. (After Slichter.)

RECOVERY OF UNDERGROUND WATERS.

Shallow waters.—The waters of the shallow zone are recovered through springs or seepages and by open or driven wells. The manner in which the former emerge has already been suggested in the paragraph relating to the ground-water table, the water coming to the surface wherever this table is cut by a valley or other depression. This natural process of recovery is supplemented by open wells, which are simply circular excavations dug from the surface to or slightly below the water table. To the use of this form of well there are many objections, some of which are considered on pages 74 and 75. (Pl. VI, *B*, p. 74) A better form of well is the driven type, which is made by forcing a pipe with an open end, or with a perforated point, downward into the ground-water body, by which process the possibility of contamination by the entrance of surface waters is prevented. (Pl. VI, *A*.) In both types of wells the water must be raised by bucket, pump, or other mechanical means. Two methods of pumping water which are in common use are shown in Pl. IV. The use of gasoline pumps promises to be very successful in localities where windmills are not practicable.

Deep-seated waters.—The deep-seated waters generally occur in gently dipping porous beds between more impervious strata. In general the water escapes at the surface only where there is a break in the impervious covering, allowing it to come up along fissures or other crevices. Springs and wells depending on deep-seated waters are more independent of rainfall, show relatively slighter changes of temperature, are more free from contamination, and are more stable in flow than those from the more shallow sources. The deep-seated waters are artificially brought to the surface by means of deep wells. In such wells the water is generally under pressure and rises far above the point at which it is encountered, in some cases reaching to or even considerably above the level of the ground at the well, though in others it may fail to reach the surface, and pumping must be resorted to. In the present paper the term "artesian" is used to designate all wells in which the water is under material hydrostatic pressure and will rise in the well when the impervious capping is penetrated.

ARTESIAN REQUISITES.

The chief artesian requisites are an inclined pervious bed lying between two impervious beds and having its outcrop at a height greater than the surface at the well, an outcrop favorable to absorption, a rainfall sufficient to furnish the necessary supply, and the absence of extensive leakage. Until recently these conditions have, in fact, been regarded by every one as essential, but it has lately been shown that flows can be obtained even in uniform sand. The arrangement of the grains in horizontal laminæ, due to stratification, so opposes the passage of the water that it can rise through the well with much greater ease than through the sand itself. In fact, it seems likely that a difference in the level of the water table in closely adjacent regions sufficient to furnish a working head is the only essential requisite of an artesian flow.[a] Four of the most common types of artesian conditions are illustrated in the accompanying diagrams (figs. 3, 4, 5, 6).

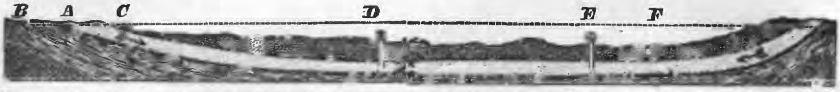


FIG. 3.—Section showing certain conditions governing artesian wells. A, a porous stratum; B, C, impervious beds below and above A, acting as confining strata; F, height of water level in porous bed A, or, in other words, height of reservoir or fountain head: D, E, flowing wells springing from the porous water-filled bed A. (After Chamberlin.)

FIG. 4.—Section illustrating thinning out of porous water-bearing bed A, inclosed between impervious beds B, C, thus furnishing conditions for artesian well D. (After Chamberlin)

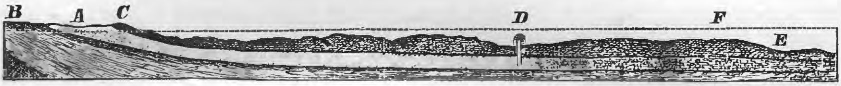


FIG. 5.—Section showing transition from porous to impervious bed. A, a close-textured, impervious bed, inclosed between impervious beds B and C, furnishing conditions for an artesian well D. (After Chamberlin.)

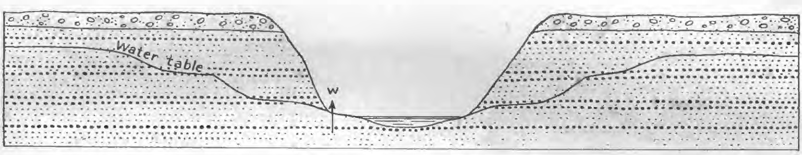


FIG. 6.—Section showing conditions favorable to flows from unconfined sandy strata. (After Fuller.)

SPECIAL CONDITIONS IN COASTAL PLAIN FORMATIONS.

In early treatises on artesian conditions it was argued that flowing wells could be obtained only in low regions with higher land on either side—that is, the artesian well must be located in a synclinal basin. But such is not the condition in the Atlantic and the southern portion of the Gulf Coastal plains.

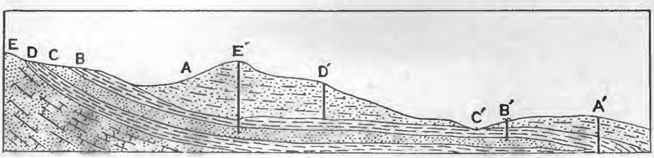


FIG. 7.—Section showing conditions governing artesian and flowing wells in the Costal Plain formations. A, surface sands—clays and sands; B, impervious stratum of clay, C, water-bearing sand; D, impervious stratum of clay; E, Pre-Coastal Plain deposits of limestone and sandstone; A′, D′, E′, common wells; B′, flowing well; C′, spring

The great series of unconsolidated sediments belonging to the Gulf Coastal Plain were deposited upon a sea floor of older rocks sloping gently seaward from their present outcrop along the foothills of the southern Appalachian plateau. The Coastal Plain sediments are thickest at the Gulf coast, where they reach a thickness of more than 2,000 feet. They become thinner and thinner to the north, finally disappearing at the outcrop of the older rocks.

[a] Fuller, M. L., Artesian flows from unconfined sandy strata: Engineering News, vol. 52, pp. 329-330.

The sand and clay sediments of Mississippi were deposited in comparatively shallow water near the old shore. In these deposits the fine supply of artesian and deep-well waters are stored. It frequently happens in this State that the sediments which are water-bearing in one locality change in character in a very short distance and become impervious to water. We shall present only five conditions, which will serve to illustrate the character of the sediments and the possibilities of getting water in the State.

In fig. 7, E represents the older rocks on which the Coastal Plain deposits D, C, B, A were laid down. C is a water-bearing sand incased between two impervious strata, D and B, which prevent the water from leaking out and keep it under hydrostatic pressure. The stratum C cuts out before reaching A′, on the extreme right side of the figure; here there is a water-bearing sand at the surface, but it will not furnish artesian water because of the lack of an upper confining stratum. A′, B′, D′, and E′ are wells. There is no flow at A′ because the artesian bed C fails to reach it. B′ enters the artesian bed C and the water flows above the surface. C′ is a spring. The well at D′ is a strong stream of good water, but does not flow because of lack of depth. The well at E′ enters the artesian sand and the water rises to within a few feet of the surface, but does not flow because the elevation of the mouth of the well is above the head of the water.

UNDERGROUND-WATER HORIZONS OF MISSISSIPPI.

The Gulf embayment includes western Florida and Georgia, southern Alabama, all of Mississippi, western Tennessee and Kentucky, southern Illinois, southeastern Missouri, eastern Arkansas, Louisiana, and southeastern Texas. Within this vast basin there are

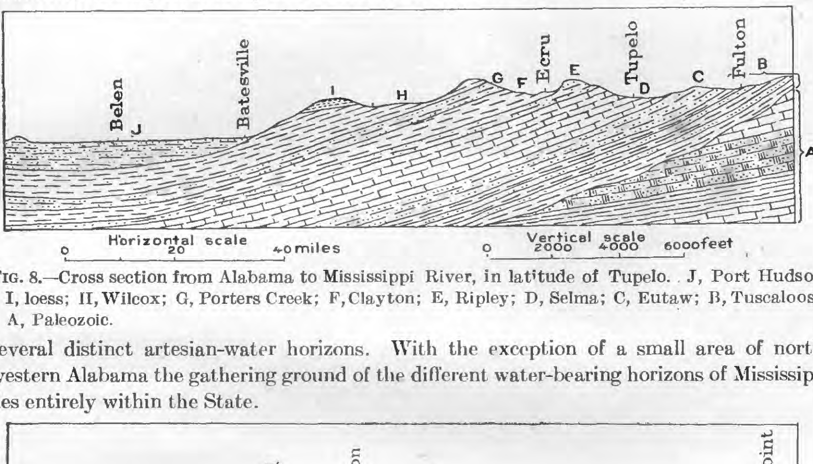


FIG. 8.—Cross section from Alabama to Mississippi River, in latitude of Tupelo. J, Port Hudson; I, loess; H, Wilcox; G, Porters Creek; F, Clayton; E, Ripley; D, Selma; C, Eutaw; B, Tuscaloosa; A, Paleozoic.

several distinct artesian-water horizons. With the exception of a small area of northwestern Alabama the gathering ground of the different water-bearing horizons of Mississippi lies entirely within the State.

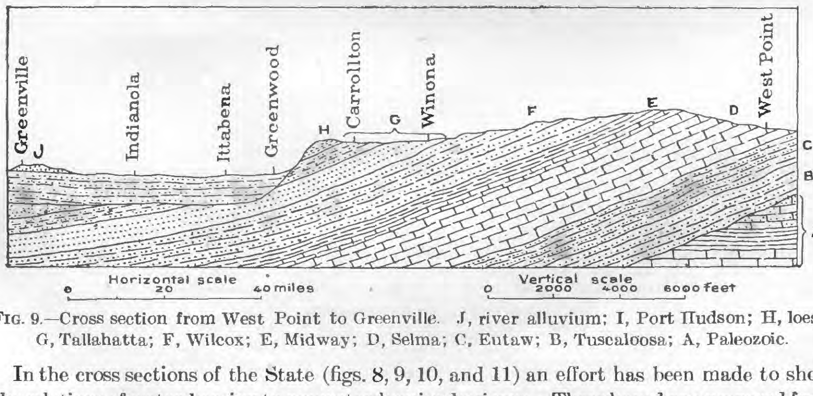


FIG. 9.—Cross section from West Point to Greenville. J, river alluvium; I, Port Hudson; H, loess; G, Tallahatta; F, Wilcox; E, Midway; D, Selma; C, Eutaw; B, Tuscaloosa; A, Paleozoic.

In the cross sections of the State (figs. 8, 9, 10, and 11) an effort has been made to show the relations of water-bearing to nonwater-bearing horizons. These have been prepared from a study of the well records and the surface outcrops of the different geologic formations.

There are seven distinct artesian-water horizons in Mississippi. Beginning with the lowest member of the Cretaceous we shall treat them as follows: (1) Tuscaloosa-Eutaw, (2) Ripley, (3) Wilcox, (4) Claiborne, (5) Pascagoula, (6) Grand Gulf, (7) Lafayette.

TUSCALOOSA-EUTAW HORIZON.

The upper division of the Tuscaloosa and all of the Eutaw formation constitute one artesian-water horizon. The lower division of the Tuscaloosa consists of heavy-bedded, compact clays of various colors. These clays form the lower confining beds of the Tuscaloosa-Eutaw horizon. The "blue rock" of the lower Selma forms the upper confining beds. Between these two water-tight beds are 1,000 to 1,200 feet of cross-bedded sands and gravel, interbedded with more or less irregular strata of sandy clays and occasional beds of lignite.

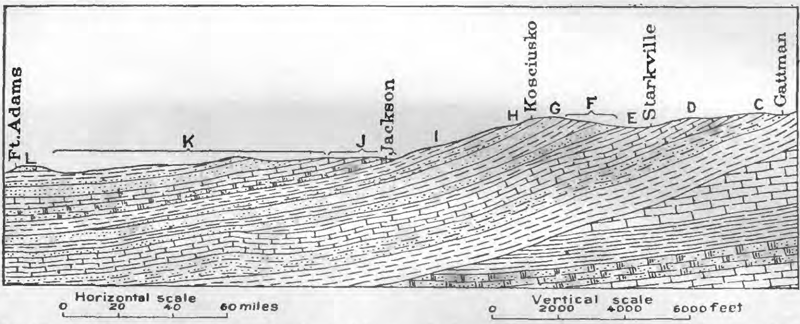


FIG. 10.—Section from Gattman to Fort Adams. L, loess; K, Grand Gulf (sandstone and clay); J, Vicksburg (limestone); I, Jackson (clays and marls); H, Claiborne; G, Tallahatta (sandstone); F, Wilcox (sands and clays); E, Midway (limestone and clays); D, Selma (limestone); C, Eutaw (sands and clays); B, Tuscaloosa (sands and clays); A, Paleozoic (limestone, etc.).

If the numerous beds of clay were continuous throughout the formations they would divide the group into separate water horizons, and no doubt some of the beds do extend over large areas and locally affect the height of the water horizons. Where these formations have been most carefully studied at the surface it has been impossible to trace any definite horizon of sand or clay for a great distance. Along some of the river bluffs, where good exposures are obtained, the material often changes within a hundred feet from a

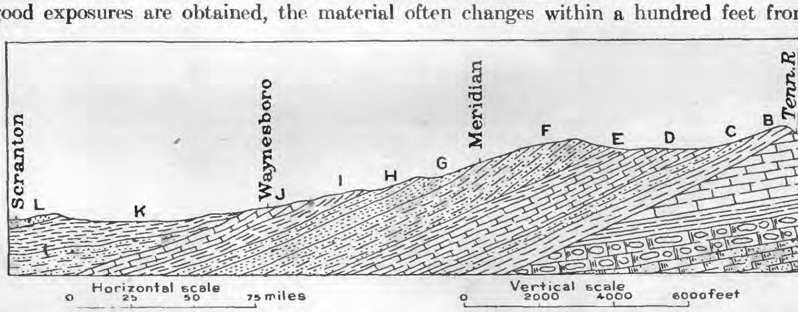
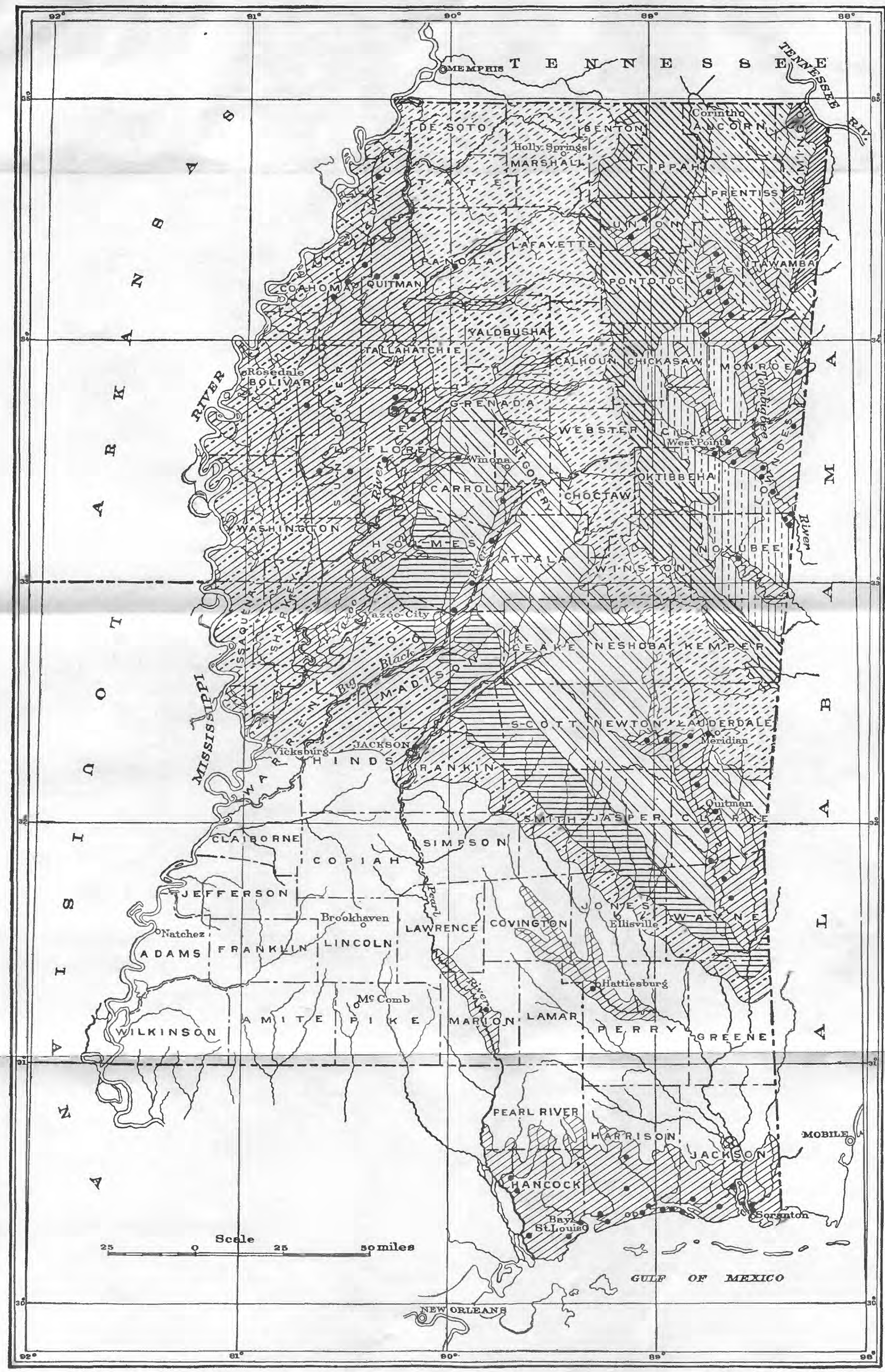


FIG. 11.—North-south cross section from Scranton to Tennessee River. L, Quaternary (silts); K, Grand Gulf; J, Vicksburg; I, Jackson; H. Claiborne; G, Tallahatta; F, Wilcox; E, Sucarnochee; D, Selma; C, Eutaw; B, Tuscaloosa; A, Paleozoic.

laminated clay to cross-bedded sands. Because of the changeable character of these formations we have considered the Tuscaloosa and Eutaw as forming one artesian-water horizon.

Catchment area.—The outcrop of the sands receiving waters of the Tuscaloosa-Eutaw horizon covers about 2,000 square miles, including practically all of Tishomingo and Itawamba counties, the eastern portions of Alcorn, Prentiss, Monroe, and Lowndes counties,



ARTESIAN-WATER MAP OF MISSISSIPPI.

Miss., and Pickens, Lamar, and portions of Marion and Franklin counties, Ala. The region where the water-bearing sands come to the surface is largely in the hilly districts east of Tombigbee River. In the southern portion of the catchment area the elevation is sufficiently high to force the water to the surface over a large area lying to the west. The catchment area from southern Tishomingo County to Tennessee is but little above the territory lying west and the result is that it is impossible to get strong flowing wells north of Baldwyn. However, plenty of good water is obtained near the surface and there are flowing wells along the lower streams to the east.

Upper confining stratum.—In an artesian basin it is necessary to have at least a confining stratum of relatively impervious material above the water-bearing sands. If there is not a confining bed below these sands the water will fill them and the underlying porous rock until a point is reached where the rocks are nonporous.

The overlying Selma chalk contains in its lower part a large amount of compact clay, which forms an impervious layer and prevents the water in the Tuscaloosa-Eutaw from escaping upward. There are areas, however, in the western region of the Eutaw where it is possible to get artesian wells. In these areas there is in the upper part of the Eutaw formation a bed of clay which is sufficiently thick to confine the water below. Farther west the water is under greater pressure and the Eutaw clay bed perhaps loses its compact character, so that the water rises to the base of the Selma chalk and overflows the surface wherever the Selma is penetrated.

Inclination of the beds.—The dip of the strata in the Tuscaloosa-Eutaw horizon varies from a westward dip of about 15 feet to the mile in the north to a south-southwest dip of 35 to 40 feet to the mile in the south. With such a steep dip the water-bearing sands soon pass beneath the overlying strata, and the greater the distance from the outcrop the more difficult and expensive it becomes to reach the artesian waters.

Area of available artesian water.—The westernmost location getting its water from the Tuscaloosa-Eutaw horizon is Starkville. The deepest well here is 1,000 feet, and the water rises to within 154 feet of the surface. Starkville is near the west outcrop of the Selma formation, in which it is impossible to get good water; but fortunately, it can be obtained over the entire area by drilling through the Selma into the Tuscaloosa-Eutaw. It must not be expected, however, that flowing wells can be obtained over the entire area. They are limited to the eastern half of the Selma prairie, extending from about the northern boundary of Lee County south to Noxubee County.

There are often erroneous ideas among well drillers and those unacquainted with the laws governing underground waters. One of the commonest is that, by going deep enough, flowing wells can be obtained anywhere. The Tuscaloosa-Eutaw is the lowest known water horizon in Mississippi, and it would be impossible to get flowing wells from this horizon west of the Selma prairie region. There are no doubt places west of the prairie region where the surface is lower than the head of this water horizon. The question may be asked, "Why can not flowing wells be obtained west of the Selma under such conditions?" But allowance must be made in this, as in all other horizons in the State, for the friction the water encounters in passing through the porous medium. The possibility of getting flowing wells decreases as the distance from the head increases. Another obstacle is the great depth of the water below the surface. If the surface dip of 30 feet to the mile continues to the west, at a distance of 100 miles from the head of the water it would require a well 3,000 feet deep to reach the water horizon.

RIPLEY HORIZON.

In going westward from the Tuscaloosa-Eutaw outcrop, or upward in the geologic column, the next artesian-water horizon encountered is a small area receiving its water from the Ripley formation. The entire area of this formation occupies approximately 600 square miles, including a small portion of Chickasaw, Pontotoc, Union, Tippah, and Alcorn counties. It includes a long triangular belt having a maximum width of 18 miles in Tippah County and forming an apex near Houston.

Catchment area.—The water of the Ripley occurs in the lower portion of the formation, which is made up of alternating strata of limestone, marl, and sand. The water-bearing strata come to the surface in the hills near the eastern border of the Ripley outcrop—that is, along the western slope of the Pontotoc divide. The country slopes westward and is drained by Tallahatchie River and its tributaries.

Upper confining stratum.—The alternating beds of sandstone, clay, and limestone of the Ripley are overlain by the heavy-bedded, compact clay of the Porters Creek formation. This clay is impervious, and confines the water in the Ripley.

Dip of the water-bearing stratum.—No accurate measurements have been made of the dip of the Ripley sands. There is but one line of wells which get their supply of water from the Ripley, and these wells are about parallel to the strike of the strata. Farther west the Wilcox has been found to have a westward dip of about 16 feet per mile, and the Selma chalk to the east has a westward dip of 10 to 15 feet per mile, so that we can assume that the inclination of the Ripley is about 12 to 15 feet per mile.

Area of available artesian water.—Flowing wells have been obtained from the Ripley horizon only along upper Tallahatchie River and some of its upper tributaries. A large number of wells have been drilled in the vicinity of New Albany and Ecru. When the first ones were drilled at New Albany, the water rose 20 to 30 feet above the surface, but the increasing number of wells soon lowered the head, and they now have to be pumped.

The writer observed for six hours the pumping of a new well at Ecru. The depth was 93 feet, and the water, when the well was completed, barely rose to the surface, as it does in the other wells in the town. After six hours' pumping with a Cook pump drawing 120 to 130 gallons a minute, the other wells in town were lowered 3 feet. This indicates that they all derive their water from the same source and that the supply is limited.

Efforts have been made to get flowing wells at Pontotoc and other places south to Houston, also at places north of New Albany, but without success. The reason is not far to seek. The elevations of Ecru and New Albany are 374 and 381 feet, respectively. At these places the water barely reaches the surface, which indicates that the head is but little above these elevations. From Cherry Creek to Pontotoc the elevation rises from 375 to 478 feet. Pontotoc is located on the crest of Pontotoc divide, and there is no higher land to the east to supply artesian water; it is therefore impossible to get flowing wells at that place. From New Albany to Ripley the elevation rises from 381 to 525 feet, thus getting above the water head to the east. The only place where flowing wells from this horizon can be expected is down Tallahatchie River, and perhaps along the headwaters of Tippah Creek in western Tippah and eastern Benton counties, and in northeastern Calhoun County along Shooner River.

WILCOX HORIZON.

The extensive outcrop of the Wilcox formation covers 8,000 square miles, including approximately the counties of Benton, Lafayette, Yalobusha, Calhoun, Webster, Choctaw, and Winston, and the larger portions of Kemper and Lauderdale counties. Only the lower division of the formation is included in the water-bearing horizon.

Catchment area.—The porous sands and sandy clays which come to the surface in the eastern half of the area and lie between the water-tight beds of the Porters Creek and the belt of clays used for stoneware at Holly Springs and Oxford make up the Wilcox artesian-water horizon. The catchment area is largely covered by the Lafayette sands, which offer but little obstruction to the absorption of the rainfall, and a large amount sinks quickly into the underlying strata.

Upper confining stratum.—The stoneware clays of Holly Springs and Oxford, which form a narrow belt of country about the middle of the formation, extending from the Tennessee line south in a semicircular direction into Alabama, form the upper confining stratum of this horizon. These clays change from a white or gray color in the north to a chocolate-brown in the central and southern areas.

Dip of the water-bearing strata.—An east-west line of wells extending from Oxford to Belen gives the following data for determining the dip of the strata, if it is assumed that the water comes from the same source:

The elevation of the well at Oxford is about 450 feet. Water was obtained here at a depth of 100 feet, or 350 feet above sea level. In the Batesville well, water was struck at 285 feet, or 51 feet above sea level. This gives a difference of 401 feet in the elevations of the water horizon. The distance between Oxford and Batesville is 24 miles. By dividing 401 by 25 we obtain the dip of the strata, which is over 16 feet to the mile. Similar calculations between Batesville and Belen give a dip of 17 feet to the mile, and between Batesville and Riverside a dip of 18 feet to the mile. We can therefore assume a westward dip in this region of 16 or 17 feet to the mile.

There are but few data for determining the dip to the south in the southern part of the formation. However, we know from the underlying and overlying strata that the dip is much greater to the south than to the west.

Area of available artesian water.—The area underlain by the Wilcox sands and sandy clays includes the entire State west and south of their outcrop; but the inclination of the beds soon carries the water-bearing strata below the reach of the drillers. Two causes tend to make flowing wells more easily obtained west of the source than south: (1) The more gentle westward dip keeps the water nearer the surface, while the dip to the south soon carries the water horizon beyond reach; (2) the elevation of the surface lying west decreases and reaches a lower level than that to the south.

The flowing wells in the Yazoo Delta north of Leflore County obtain their water from the Wilcox. South of this area water is found in a different horizon. In the western and southern portions of the delta the distance from the source has become so great that the water fails to reach the surface on account of the friction it encounters in passing through the sands. There is but a small area outside of the northern part of the delta where flowing wells are obtained from the Wilcox horizon. Those at Water Valley and Coffeeville, many in Lauderdale, and a few in southeastern Newton, and perhaps in northern Clarke County, get their waters from the Wilcox.

CLAIBORNE HORIZON.

We have considered the white and chocolate-colored stoneware clays near the middle of the Wilcox formation as the division between the Wilcox and Claiborne water horizons. They form the upper confining beds of the Wilcox and the lower confining beds of the Claiborne. If there were a water-tight bed at the top of the Wilcox, there would be two water horizons belonging entirely to this formation; but, since this upper impervious bed is wanting, we should consider the sands and sandy clays above the stoneware clays as a part of the Claiborne formation.

Catchment area.—Besides the area of the upper Wilcox the catchment area of the Claiborne includes a belt from 12 to 40 miles wide extending from Grenada County south-southeast through Carroll, Attala, Leake, southwestern Neshoba, Newton, Lauderdale, and Clarke counties. The belt is narrowest near the Alabama line and widest in Leake County. The outcrop of the strata of the Claiborne horizon includes beds of unconsolidated micaceous sands, sandy clays, and more or less coarse-grained micaceous sandstone. There is in the Tallahatta buhrstone at least one horizon of very compact quartzose sandstone. All of the Tallahatta, with the possible exception of the quartzose sandstone, is capable of holding a large amount of water in saturation. Over much of the area the Lafayette covers the surface. Along many of the streams and hillsides the Lafayette has been removed by erosion and the porous sands and sandstones of the underlying formations are exposed. Besides the direct absorption of the rainfall into the porous strata there are a number of streams which lose a large amount of their waters in passing over the inclined edges of these strata. The water sinks quickly into the open-textured sands, and many of the smaller streams flow but a short time after even a hard rainstorm. This is particularly true along the upper courses, where the streams have not silted up their beds with impervious clays. The absorption is greater in summer than in winter.

Upper confining stratum.—The upper confining stratum of the Claiborne horizon consists of a series of "soapstone" and pipe-clay beds which belong to the basal part of the Lisbon formation. Well drillers say that in places flowing water is found just beneath a very hard "flint" or sandstone, which is perhaps the quartzose sandstone of the upper Tallahatta.

Dip of the water-bearing strata.—The dip of the strata to the west, as shown in the well records between Winona and Indianola, is as follows: If the waters derive their supply from the same source, there is a dip in the water horizon between Winona and Greenwood of 18 feet to the mile, though one well at Greenwood would give a dip of only 10 feet to the mile; the dip between Greenwood and Ittabena is 20 feet to the mile; between Ittabena and Indianola 35 feet to the mile.

The well at Jackson gets its water at a depth of 1,168 feet. The elevation of the top of the well is about 280 feet above sea level. Estimating the head of the water supplying the well to be 100 feet higher than the surface at Jackson and the distance from the source to the well to be 50 miles, we get a dip of the water-bearing sands of 25 feet to the mile.

Various estimates made from records of the wells along Chickasawhay River give a southward dip of the water horizon of from 10 to 20 feet to the mile.

Area of available artesian water.—The area of accessible artesian water coming from the Claiborne horizon includes the larger part of the Yazoo Delta lying south of a line running from Grenada to Rosedale, and the central prairie belt extending from Yazoo to Waynesboro, on Chickasawhay River.

The area of flowing wells occupies a much smaller territory. In the delta it includes Leflore County, the larger part of Sunflower County, and the northern part of Holmes County. West of this the water encounters too much friction to give good flowing wells. A well 1,567 feet deep at Yazoo failed to obtain a strong flow. The city well at Jackson is perhaps the most distant one receiving its water from the Claiborne horizon. This well is 1,168 feet deep and gives a strong stream. The water is highly impregnated with minerals and too warm to be palatable for drinking. There are numerous flowing wells along Chickasawhay River, from Waynesboro to near Decatur, in Newton County; those south of Enterprise receive their waters from the Claiborne horizon.

PASCAGOULA HORIZON.

Immediately underlying the Grand Gulf formation is a series of older Miocene beds which outcrop along Chattahoochee River in Florida and also along Conecuh River in southern Alabama. From fossils collected by Mr. Johnson along Chickasawhay River a few miles above the mouth of Leaf River it has been shown that there is a horizon here bearing a fauna which is much older than the Vicksburg. He has called the beds Pascagoula, and refers them to the Miocene. It has not been conclusively proved that the Pascagoula is the same horizon as the Chattahoochee beds, but the fossils which were collected have been referred to the Miocene. It is quite probable that many of the deeper wells along the coast derive their supply of water from the Pascagoula, but as the formation has been recognized only along the Pascagoula River nothing is definitely known about its water-bearing capacity.

GRAND GULF HORIZON.

But little detailed geologic work has been done over a large part of the Grand Gulf area from Jackson to the Gulf, and the character of the water-bearing horizons is known only in a general way. The southern counties of the State are covered deeply by two great surficial formations, the Grand Gulf and the Lafayette. The great well at Rose farm and another at Wilson Springs, north of Moss Point, demonstrate that there is another important water horizon underneath the Grand Gulf. The greater part of the wells along the coast find flowing water at 500 feet, more or less, and many toward the west at 300 feet and lower None of these flow with the great pressure of the deeper wells, nor do they furnish so great a supply. From only one of the shallower wells have fossils been obtained—that at Logtown, on Pearl River—but as yet they are undetermined.

Mr. L. Sutter, one of the most skillful and observant drillers of the coast, says that there are four distinct artesian water-bearing strata on the coast. This does not include the one immediately under the alluvial sands at a depth of 100 to 200 feet, which sometimes flows and sometimes does not. One horizon is reached at about 300 feet from which water occasionally rises to the surface; a second at 400 to 500 feet often gives a strong flow, and the majority of owners are content to stop here; a third is at 600 to 700 feet, in which there is generally gravel and a good flow of water; the last flow comes from a depth of 800 to 1,000 feet, and has a strong pressure and abundant supply.

The lowest member of the Grand Gulf formation is a bed of impervious clay about 75 feet thick. Resting on the clay is a series of sandstones alternating with grayish and often lignitiferous clays. These sandstones and open clays form the water-bearing strata of the Grand Gulf.

Catchment area.—The sandstones and lignitiferous clays come to the surface along the northern area of the Grand Gulf formation. In the northwestern portion the sandstone is more prevalent than the lignitiferous clays. It alternates with thin strata of gray clay, as is shown at Star and Raymond, and in various places in southern Rankin, Hinds, Simpson, Copiah, and Claiborne counties. Along the northern outcrop of the Grand Gulf in the eastern part of the State the sandstone is wanting. The strata here are lignitiferous, sandy clays containing leaf impressions and often fragments of lignitized wood. But the material is porous enough to absorb a large amount of water, which is easily recognized by its character when it again comes to the surface. The large amounts of gypsum and common and magnesian salts, the small quantities of iron pyrite, and the decayed vegetable matter render the water in places unsuitable for drinking.

Upper confining stratum.—The upper confining beds of the Grand Gulf horizon consist of the extensive clay beds outcropping in the vicinity of Hattiesburg.

Dip of the water-bearing strata.—If the wells at Laurel and Ellisville derive their supply from the same horizon, the southward dip of the strata is about 11 feet to the mile. The dip between Ellisville and Hattiesburg is, according to the data in hand, much less. We have but one well record at Ellisville on which to base our estimates, which are no doubt too small.

Area of available artesian water.—The sandstones and porous clays forming the catchment area of the Grand Gulf horizon soon pass beneath younger deposits. Flowing wells are obtained at Taylorsville, Hattiesburg, Columbia, and along the coast. There is a large area lying north of a line drawn from Leakesville through Hattiesburg, Monticello, Brookhaven, and Natchez, where deep-well water can be obtained at a maximum depth of 800 feet. Flowing wells should be found along the larger streams at a much shallower depth.

Below is a generalized section of wells between Biloxi and Pass Christian. The record was given to G. D. Harris, for his "Underground Waters of Southern Louisiana," by Mr. A. Dixon, a practical well driller of that region.

Generalized section of wells between Biloxi and Pass Christian.

	Depth in feet.
6. Sand	80
5. Clay	125
4. Sand and clay	425
3. Light-gray fine sand	500
2. Clay	600
1. Water-bearing sand	685

It will be seen by consulting the section that No. 2 is a bed of clay extending in depth from 600 to 685 feet, with a water-bearing sand below. No. 1 is no doubt the water-bearing sand belonging to the lower horizon, and the clay of No. 2 is the impervious bed at the top. Some drillers say that the clay coming immediately above the water horizon has a bluish-green color and is often 150 feet thick.

The large number of wells along the coast which draw their supply from this horizon indicates a large catchment area. Those who have flowing wells usually let them flow at full pressure, the amount of water used being but a small fraction of the amount wasted. Well owners should bear in mind the possibility of overdrawing the supply. New wells are being constantly drilled, and this also tends to lessen the amount for each well. Good water such as that found in the deep wells along the coast is a great blessing to the people living there, and a cessation of the flowing wells would be keenly felt. Fortunately, the supply so far has been adequate for all purposes.

LAFAYETTE HORIZON.

The most recent formation in the State furnishing artesian water is the Lafayette. Over the larger portion of the State it forms a mantle up to 200 feet in thickness resting unconformably upon the older formations. The Lafayette passes beneath still younger strata at a distance of 15 to 30 miles from the Gulf and is found in the coast wells at a depth of 150 to 350 feet below tide. North of the point where the Lafayette passes under cover of the other formations, it forms one of the principal sources of the shallow-well waters of the State.

Catchment area.—Along the Gulf and Ship Island Railroad south of Hattiesburg there are thick beds of coarse sand and fine gravel belonging to the Lafayette. They overlie the bluish-green clays at the top of the Grand Gulf horizon, and are in turn overlain by more recent clays. The surface between these two clay layers forms the catchment area of the Lafayette. It is less extensive than the Grand Gulf horizon, but the material is much more porous and therefore contains more water to the cubic foot.

The elevation of the catchment area is sufficient to force the water to a maximum height of 20 feet above the surface. At a distance of 25 miles from the Gulf the elevation along the Gulf and Ship Island Railroad reaches 250 feet. If this elevation were continuous across the State from east to west, the water in the coast wells receiving their supply from this horizon would rise to a much greater height than it does; but the streams have cut their channels to such a depth that the head of the water is much below this elevation.

Upper confining stratum.—The recent clays along the coast rest unconformably upon the Lafayette horizon, and form its upper impervious stratum. From the various reports of the drillers the coast wells from Scranton to Pearl River strike the Lafayette sands and gravel at from 150 to 380 feet. The upper confining bed of clay is reported to be 35 to 100 feet thick. The following table, compiled from the well records from Scranton to Pearl River, gives some interesting facts relating to the pressure and depth of the wells:

Wells between Scranton and Pearl River.

Locality.	Wells less than 500 feet deep.	Wells with flow less than 30 feet above surface.	Wells more than 500 feet deep.	Wells with flow 30 feet and more above the surface.
Biloxi	7	5	15	17
Gulfport		2	6	4
Longbeach		1	2	1
Mississippi City		3	6	3
Pass Christian	2	7	30	25
Fontainebleau			2	2
Moss Point		2	3	1
Ocean Springs		5	13	8
Scranton			2	2
Bay St. Louis	9	8	4	5
Waveland	7	7		

By comparing the depths with the pressures in the table above, it will be seen that the water coming from a depth less than 500 feet has a different source from that of the water coming from a greater depth. Wells with an approximate depth of 500 feet or more have a much greater pressure than shallower wells. In most of the former the pressure is sufficient to force the water 30 feet or more above the surface, the maximum height being 80 feet. A well at Bay St. Louis, 250 feet deep, has a greater pressure than any of the other shallow wells, and the height of flow above the surface is 20 feet.

Dip of the water-bearing strata.—By comparing the distance from the outcrop of certain beds with the depth at which they are found in the coast wells, a southward dip of about 15 or 20 feet to the mile is estimated.

Area of available artesian water.—The artesian area of the Lafayette is comparatively limited. Some of the more shallow wells along the coast obtain their waters from this horizon. The entire area of the Lafayette which is covered by later formations is but a few square miles, extending about 20 miles north from the coast and including the southern portions of Harrison, Hancock, and Jackson counties.

NOTES ON WELLS OF MISSISSIPPI, BY COUNTIES.[a]

Adams County.—The surface of Adams County is very irregular. In the eastern part the Grand Gulf formation is overlain by the Lafayette. Near Mississippi River the loess overlaps all the other formations and extends from 5 to 10 miles from the river. The wells of this county derive their waters from two sources. The shallower wells are supplied with soft, palatable water from the base of the Lafayette, and the deeper wells from the sands of the Grand Gulf.

The city waterworks company of Natchez has four wells located near together, 56 feet above the river. An examination of the water from No. 1*a* shows 37½ parts solids to 100,000 parts of water, and a hardness of 7½. Well No. 2 contains 27 grains of solids to the gallon, and shows the presence of a very small number of innocuous bacteria. The log of well No. 4 shows 160 feet of loess, 50 feet of Lafayette, and 220 feet of Grand Gulf material. Well No. 9 is located on the Greenville plantation, 7½ miles from town. There are hundreds of wells of this character in the western part of Adams County, the water generally being obtained at the contact of the Lafayette and the underlying Grand Gulf. The log of well No. 9 showed 12 feet of Lafayette and 85 feet of Grand Gulf, to which the water owes its hardness.

Alcorn County.—The Lafayette has been removed from a large part of the surface of the county, which is a gently rolling plateau sloping in a northwest direction to Hatchee River. When the first wells at Corinth were drilled the water rose to the surface, but was lowered several feet below the surface by additional wells. An effort has been made here to get wells which would flow, but the prospects are not very encouraging, since the source of the water is but little above the elevation of the town. There is a bare possibility of striking an artesian flow in the older, hard rocks at a depth of several hundred feet. These rocks come to the surface in northern Alabama and Tennessee at an altitude sufficiently high to force water to the surface at Corinth. However, the disturbance of these older rocks has caused them to be so folded and jointed that it would be a risk to undertake such a project. The log of one of the Corinth waterworks wells, No. 11, shows 20 feet of Lafayette, 280 feet of undifferentiated Cretaceous, and 45 feet of Lower Carboniferous or Devonian.

Amite County.—No well records were obtained from this county. Flowing wells are not probable.

Attala County.—The only well reported from this county is No. 12, at Kosciusko. In this well two fossiliferous beds of clay were penetrated, the first at a depth of 65 feet and the second at 150 feet. Water first entered the well at a depth of 76 feet and now stands at that level.

Benton County.—All shallow-well water in Benton County is obtained from the Lafayette and Wilcox formations. There is a possibility of getting flowing wells from the Ripley sands along Tippah Creek in the eastern part of the county at a depth of about 400 feet.

[a] A partial list of the deep wells in Mississippi is given in the table on pages 40-59. The well numbers in the text refer to this table.

Bolivar County.—This is one of the Yazoo Delta counties bordering on Mississippi River. The shallow wells receive abundant water from the Port Hudson formation, but it contains much organic matter and is therefore very unwholesome. These shallow wells are made by placing a cap on the end of a pipe, perforating the lower portion, and driving the pipe into the ground. Water enters the pipe through the perforations and is raised to the surface by a pump.

The deep wells reach the Claiborne horizon, but are so far from the head that the pressure is greatly lessened by the friction the water encounters in passing through the sands. In most of the counties of the Yazoo Delta bordering the Mississippi the water fails to rise to the surface.

Calhoun County.—This county is traversed by two large streams flowing west, Yalobusha and Shooner rivers. Between these streams is a narrow divide which rises more than 200 feet above them. On the higher ridges and, in fact, everywhere except along the streams the Lafayette is very thick. At its base is a water supply abundant for all ordinary domestic uses. Wherever possible, this water should be used in preference to the deeper well waters, which in this region are apt to be strongly impregnated with mineral salts.

Carroll County.—Carroll is one of the counties bordering the eastern rim of the Yazoo Delta. Its western part is therefore but little above Yazoo River, and flowing wells are easily obtained. The greater part of the county is in the Claiborne hills, where flowing wells are possible only along the lower streams.

The town of Carrollton, near the center of the county, has a large number of flowing wells. It is situated on Big Sandy Creek and has an elevation of 229 feet above sea level. Well No. 17 was drilled 1,250 feet deep, but failed to get an overflow. The first water from the upper Claiborne, at 300 feet, rose to within 17 feet of the surface. A second stream at 450 feet came within 12 feet of the surface. These water beds were cased off and no further supply was obtained. Water from well No. 18 is delivered by a ram to a tank, from which it is distributed over south Carrollton.

Chickasaw County.—The eastern half of this county is underlain by the Selma chalk and the western half by the Porters Creek and Wilcox beds. The water from the Tuscaloosa-Eutaw horizon will rise to the surface in a narrow strip in the northeast corner of the county. Some surficial waters are obtained from the base of the Lafayette where that formation is present, but the general supply of wholesome water comes from the deep wells which reach the Tuscaloosa-Eutaw horizon. Water from well No. 20 at Okolona is forced into a tank by compressed air and is thence distributed over the town.

Choctaw County.—It is not surprising that no artesian wells are reported from Choctaw County, as the high Pontotoc divide extends through its eastern part. At Blantons Gap, 2 miles east of Ackerman, the Illinois Central Railroad reaches the highest elevation between Durant and Aberdeen.

The only possibility of getting flowing wells in the county would be along Big Black River, on the northern and northwestern boundary. Good surficial water is obtainable from the base of the Lafayette, which is exceptionally thick over this region.

Claiborne County.—Good water is obtained in shallow Lafayette and Grand Gulf wells, but there is no artesian flow.

Clarke County.—Clarke County is one of the Alabama-Mississippi border counties lying along Chickasawhay River. The nearness to the catchment areas of the Claiborne and Wilcox formations and the large area of low-lying territory along the Chickasawhay cause many artesian wells. The county is crossed by the Lisbon beds, the Tallahatta buhrstone, and the Jackson formation, while the upper Wilcox crosses the northeast corner, and the Vicksburg the southwest corner. The Lafayette is also very thick back from the larger streams.

Well No. 22, at Barnett, was started in the Jackson marls, which were 65 feet thick. Water was obtained in the sands immediately underlying, and again in sands at 125 feet. At a depth of 350 feet all the water left the well and passed off through the sands at that point. The well was cased for 150 feet. In well No. 23, also at Barnett, water was obtained at 65 feet and rose 25 feet in the well. At 125 feet another stream was struck which rose to within 20 feet of the surface. As in well No. 22, all the water was lost in the sands at a depth of 350 feet. None was found below that level.

Well No. 24, at De Soto, begins near the top and ends near the bottom of the Lisbon beds. The water has a reddish color like other water coming from this horizon.

The town of Enterprise has two wells (No. 25) about 100 yards apart and of the about same depth. They are affected by a large well drilled at a sawmill a few hundred yards north. The log from well No. 26 showed 22 feet of Lafayette. When first drilled this well had a weak flow. Three other similar wells, from 175 to 200 feet in depth, are located in the neighborhood. Well No. 29 is on the west side of the river and on higher ground than those above mentioned. The Lafayette is here very thin and is underlain by a 10-foot Claiborne shell bed. When the mercurial barometer is high the well flows, but usually it has to be pumped.

About 15 wells have been bored in the town of Quitman. The log of well No. 31 showed 40 feet of Lafayette, 40 feet of Lisbon, 150 feet of Tallahatta buhrstone, and 2 feet of Wilcox. The volume of water has been lessened by the large number of wells. Some of the larger wells used for supplying water for the Mississippi Lumber Company are pumped by compressed air. During the pumping the flow of other wells in the town is either decreased or stopped. Well No. 33 was the first one drilled in Quitman. The flow has been much reduced by the drilling of other wells. The Lafayette in this well was 30 feet thick. To the east in the hills the Lafayette is from 40 to 100 feet thick.

Well No. 34 is the public well at Shubuta. A weak overflow of clear water was obtained at a depth of 175 feet, but the main flow is from 400 feet and is a red water, which is alkaline in character and carries 62 grains of sodium bicarbonate to the gallon. Sixteen flowing wells and 1 nonflowing are reported from the town of Shubuta, and they range in depth from 165 to 422 feet. The maximum height to which the water rises above the surface is 30 feet. There are two distinct water horizons in the Shubuta wells, both of which yield highly alkaline waters. The first horizon, at 165 to 175 feet, yields a clear alkaline water with a pressure sufficient to raise it to a maximum height of 15 feet above the surface. The second horizon, at about 400 feet, yields a red alkaline water which is typical of all waters coming from the uppermost Lisbon beds. The pressure from this level raises the water 20 to 30 feet above the surface. Well No. 43 is 1 mile east of town, on low ground near the river. Well No. 45 is 2½ miles north of town.

Clay County.—The whole surface of Clay County is underlain by the Selma chalk, except a narrow strip 2 to 5 miles wide along Tombigbee River on the eastern border. Over the entire country the water from the Tuscaloosa-Eutaw horizon will rise in wells to within a few feet of the surface. In some localities in the eastern part the water flows over the surface.

The drill in well No. 52 at West Point penetrated more than 500 feet of the Selma, beneath which an unusually pure water was obtained. This well has a weak but steady flow. Later wells, however, have lowered the height of the water.

Coahoma County.—The artesian wells from this part of the Yazoo Delta get their flow from 700 to 1,000 feet below the surface. There is a marked difference in the pressure and quantity of water in some of the wells.

At the town of Clarksdale the city well (No. 53a), which is 876 feet deep, flows a very weak stream of 3 gallons per minute. The well at Lyon (No. 55), only 2 miles north, is 975 feet deep and flows a strong stream of 22 gallons per minute. This well, however, obtains its water from the 970-foot level, which is 94 feet lower than the Clarksdale well. No doubt the latter would strike the same water at the depth of the Lyon well. An analysis of the water from well No. 55 shows 3774.6 parts per million of solids, of which 2738.9 parts are sodium carbonate.

Copiah County.—This county is in the region of the Grand Gulf formation, which is in places deeply covered by the Lafayette sand and gravel. A high ridge extends north and south across the county, separating the waters of the Pearl on the east from those of the Mississippi on the west.

Water was obtained in well No. 56, at Wesson, at a depth of 120 feet in the lignitic clay of the Grand Gulf. It was so highly impregnated with vegetable matter and alkalies as to be unfit for drinking purposes. It is stated that a boring 1,100 feet deep near Wesson failed to obtain water. The drinking water in this locality is obtained from wells at the base of the Lafayette.

Covington County.—The well waters from Covington County come principally from the lower members of the Grand Gulf. There is more or less mineral matter in the water, often rendering it undesirable as a constant drinking water.

De Soto County.—The log of a well in Hernando shows the following relations: Flint gravel 45 feet, yellow clay 20 feet, brown shale 25 feet, light-brown shale 55 feet, hard shell or hardpan 1 foot, light-gray shale 24 feet, and sand 50 feet.

The well was made in sand, is 10 inches in diameter, and has a capacity of 150 gallons daily. Water is raised by a deep-well pump and stands 20 feet below the surface. The quality is about like that of the Memphis water.

Franklin County.—Shallow wells are obtained in Franklin County from the Lafayette and Grand Gulf. Artesian wells are not possible.

Greene County.—Artesian wells may be obtained along Chickasawhay River, in the eastern part of the county. There are as yet no records of any deep wells in this county, perhaps because of the small population.

Grenada County.—Grenada County is cut from east to west by Yalobusha River. Along the lower course of the river on the eastern edge of the Yazoo Delta there are numerous artesian wells.

The town of Grenada is supplied by deep-well water, which is pumped to a large standpipe on a hill about 1 mile from town and from there distributed over the city through pipes. The hill on which the standpipe is located is about 150 or 175 feet above the city and a strong pressure is thereby obtained.

Hancock County.—Hancock County is the most western county bordering on the Gulf. The drainage is toward the south and southwest. The geologic formations belong to the post-Tertiary period. The region of flowing wells includes a strip along Mississippi Sound 5 to 10 miles wide and likewise the region along the Pearl River bottom on the west side of the county.

Twenty-three wells are reported from this county. The temperature of the deeper wells is reported to be 78°. Notes on some of these wells are given below. The numbers correspond with those in the table (pp. 42–45):

No. 57. This well has no strainer at the bottom and became clogged, its flow diminishing from 50 gallons per minute to nothing. After partly cleaning, a flow of 15 gallons per minute was obtained, but this has now decreased to 8 gallons.

No. 58. This second college well is located 1,000 feet from the first. The original flow was 60 gallons per minute, but the well later became entirely clogged. A flow of 5 gallons is now obtained.

No. 59. Abundant gravel, similar to that on Bayou de Lisle, 10 miles northeastward, was found at 40 feet, while at from 175 to 300 feet univalve and clam shells were found.

No. 60. This is one of the shallowest wells at this point. There are some fluctuations of flow of the shallower wells, thought by drillers to be connected with tidal fluctuations.

No. 61. This is one of the best wells at Bay St. Louis. The water is used in a canning factory. A cypress log was encountered at 90 feet, and many fossil shells at 200 feet.

No. 62. In the winter of 1893-94 this well ceased to flow, but began again in the spring and has continued ever since. The flow fluctuates a little with the tide.

No. 63. Fossil shells were found at 170 feet, but none were preserved.

No. 64. This well is 16 feet above tide level. It flows at high tide, but not at low. During storms which raise the water level the flow is greatly increased.

No. 65. This well does not ordinarily flow, but during storms which raise the water of the Gulf it flows freely.

No. 66. Rotten wood, apparently cypress, was encountered at 100 feet and gravel at 190 feet. Water was found at this point, but the well was continued to the second water-bearing stratum at 420 feet. The gravel resembles that at Bayou de Lisle, 10 miles northeast.

No. 67. A good water horizon was passed through at a considerable distance above the one from which the supply is now obtained.

No. 69. This well is located on Bayou Tally, several miles north of town. Fossil shells were found at 40 feet, but none were preserved.

No. 71. Three sources of water were found—one under the Port Hudson, one under the Lafayette at 160 feet, and one near the top of the Grand Gulf at 225 feet.

No. 73. The elevation of this well, like practically all of those at Waveland, is 16 feet above tide. This is the shallowest well at Waveland, the well stopping at the first water-bearing horizon.

No. 74. Water was obtained at 320 feet, but was supposed to be insufficient, and the well was continued 40 feet into the clay.

No. 75. The stratigraphy shown by the wells in Waveland is similar to that at Bay St. Louis.

No. 76. West of Bay St. Louis.

No. 78. This well was continued into the clay several feet below the water-bearing sand.

Harrison County.—This county offers a diversity of topographic features. The southern part, bordering on Mississippi Sound, is but a few feet above tide. Twenty-five miles from the coast the Gulf and Ship Island Railroad reaches an elevation of 270 feet, while the hills to the west rise perhaps 100 feet higher. At the northern edge of the county the railroad reaches 305 feet elevation. These high hills furnish the outcrop of the geologic formations which supply the high-pressure wells along the coast. The entire coast in the southern part of the county is perforated by wells, some of which will force the water 80 feet above the surface with a flow of 450 gallons per minute.

In well No. 102 fossil shells were found at 340 feet, but none were saved. The well supplies a large sawmill and furnishes water for the village of Delisle.

The wells at Pass Christian (Nos. 122–153) are about 16 feet above tide and all have a strong flow, which increases with depth. The supply of the deeper wells appears to come from fossiliferous beds which Mr. L. C. Johnson has referred to the Pascagoula. The water from the shallower wells comes from one or all of the three water-bearing sands above the so-called Pascagoula. The temperature of wells 700 feet deep is 71°.

Hinds County.—The waters of the eastern part of Hinds County flow to Pearl River and those of the western part to the Big Black. It is difficult to obtain good drinking water in the Jackson and Vicksburg formations, which underlie the surface in the northern part of the county. More than half of the southern part is underlain by the Grand Gulf formation, which is here represented by white to gray sandstone, interbedded with sandy clays and unconsolidated sands. The Lafayette covers the surface of the entire county except in small areas.

The high bluffs along Big Black River are covered with loess, which overlies all the other formations. It gradually thins out to the east, becoming so closely blended with the yellow loam that the two are inseparable. The transition zone will stand erosion better than the unmixed yellow loam. Most of the water in this county is obtained in shallow wells, which derive their supply from the base of the Lafayette.

There are four flowing wells in Jackson. The city well is located on the bank of Pearl River, not far from the wagon bridge. The well is 1,168 feet deep and flows a strong stream of strongly alkaline, warm water. It is so highly charged with minerals that it is not used for any purpose. The source of the water is perhaps the upper Claiborne. The temperature of one of the Jackson wells, 774 feet deep, is reported by Darton to be 74°.

The deepest well (No. 157a) in this section is at Bolton. At a depth of 1,020 feet a fine stream of excellent drinking water was obtained, which rose to within 80 feet of the surface. The well was continued to a depth of 1,517 feet, but no further streams were obtained. At a depth of 1,080 feet the first rocks were found. They occurred in bands 1 to 5 feet thick to the bottom of the well.

Holmes County.—The topography and stratigraphy of Holmes County is very similar to that of Carroll on the north. It contains a high north-south ridge near the center and two low-lying regions on either side. In both of these low areas are numerous artesian wells deriving their waters from the Claiborne horizon.

Water was first obtained in the well at Pickens (No. 159) at 160 feet, but it was of poor quality. An analysis of the water from the Tchula well (No. 160) shows it to be too alkaline for boiler purposes.

Well No. 162 is located in Attala County, 1 mile from West. It is cased down to solid rock of the lower Tallahatta at a depth of 100 feet. The water comes from beneath the hard rock.

Issaquena County.—Issaquena is a small county bordering on Mississippi River in the southern part of the Yazoo Delta. The surface formations are recent river deposits and Port Hudson, both of which furnish plenty of surficial waters of a poor quality. The region is too far removed to get flowing wells.

Itawamba County.—The Tuscaloosa sands furnish a large amount of fine water over the entire county. There are numerous springs in the western part of the county which issue from just above lignite seams and clay beds belonging to the Tuscaloosa. No doubt flowing wells could be obtained along Tombigbee River, but none are reported.

Jackson County.—The eastern and western parts of Jackson County rise to an elevation of about 300 feet. The central part along Pascagoula River is but a few feet above tide. Like the other two coast counties, the southern part of Jackson has a large number of flowing wells. Twenty wells are reported from Jackson County, and the following notes are given in addition to the data in the table (p. 48–51):

No. 163. Fossil shells were found at 640 feet.

No. 164. Fossil shells of the Pascagoula were found at 500 feet. The formation is here probably about 100 feet thick.

No. 166. This well goes 300 feet below the base of the Pascagoula, assuming the latter to have its normal thickness. It does not, however, reach the Jackson or Vicksburg formations. Mr. L. C. Johnson considers that it may end in the Chickasawhay Miocene beds.

No. 167. This well was bored for oil. At 680 feet it passed through a thin bed of gray sandstone, probably at the base of the Grand Gulf. The water at this level was of a brownish color and flowed 50 gallons to the minute, but was cased off. Woody matter was encountered at 720 feet. The well is located 4 miles north of Moss Point.

No. 168. Most of the city is supplied from this well.

No. 171. The water of wells of this depth is better than that from the deeper wells.

No. 177. The horizon of the water bed is fixed by fossils.

No. 178. This well is used for irrigation.

No. 179. This well was begun for oil, but was abandoned because of the sticking of the drill. It still flows considerably, although the main water horizon at 900 feet was cased off. Fossils of the Pascagoula horizon were encountered below 900 feet. Some wood, lignite, and pyrite were also found.

No. 180. It is probable that the water supply is from a sand bed 40 to 50 feet above the Pascagoula marl.

No. 182. Fossil shells of the Pascagoula formation were found below 600 feet.

Jasper County.—There are 10 wells reported from the town of Paulding, with an average depth of about 80 feet. The water rises only 10 feet in the wells. At a depth of 90 feet the Jackson marls are reached. Water coming from the base of the Lafayette is reported to be good and soft, while wells bored into the Jackson have hard water. The wells are bored with a hand auger.

Jefferson County.—No wells reported.

Jones County.—The Grand Gulf clays underlie the entire county. The more sandy clays are water-bearing, but the southward slope of the land is so gentle that the water does not rise to the surface except in the southern portion of the county. It rises to within 40 feet of the surface at Laurel (No. 184) and to 20 feet at Ellisville, which is 7½ miles farther south. If the dip of the water horizon is constant, the water should rise to the surface in wells 8 miles south of Ellisville, provided, of course, the elevation is no higher than at Ellisville.

Well No. 186, at Laurel, obtained its first water at 65 feet, and water was found at various levels until the large supply was reached at 370 feet. The well is cased for 250 feet, the lower 20 feet being brass screen.

Water has been obtained at Ellisville at 70 feet, clearly within the Grand Gulf; and again at 500 feet, possibly at the base of the Grand Gulf, but this is not certain. In neither case did the head force the water to the surface.

Kemper County.—In the eastern part of the county deep-well water, perhaps flowing, can be obtained from the Tuscaloosa-Eutaw horizon by penetrating the Selma chalk. In the western part numerous shallow wells are obtained at the base of the Lafayette. In some places, where the Lafayette has been cut through, bold springs of pure, soft water are found.

Lafayette County.—This county occupies the central portion of the Wilcox area. In general there is a thin layer of Lafayette overlain by a thicker mantle of the Columbia loam, which reaches a maximum thickness of 20 feet. In the eastern and particularly in the southeastern part of the county are numerous outcrops of lignite veins along the streams.

The county is traversed from east to west by two large rivers, the Yocona on the south and the Tallahatchie on the north. The principal water supply is obtained from the heavy-bedded sands in the Wilcox.

Lamar County.—This has recently been formed from Marion County, and the wells are discussed under that head.

Lauderdale County.—The high line of hills forming the divide between the Tombigbee and Chickasawhay basins extends in a southeast-northwest direction across the central part of the county. The Wilcox and Claiborne strata, outcropping to the south and west, form the catchment area for the artesian wells in the southern portion of Lauderdale and Clarke counties.

From well No. 190, at Lauderdale, 35,000 gallons were pumped in a five-hour test. There is some iron in the water, but it can be used in boilers. The drill passed through solid beds at about 70 feet below the surface, presumably Wilcox. In No. 192 water was first obtained at 135 feet, but it was from a bed of lignite and was of poor quality. The well stopped in a soft, yielding clay which caved badly. The water from well No. 194, coming from the Wilcox, is very hard, but is used in locomotives. The well has yielded 7,000 gallons per hour.

Well No. 196, at Meehan Junction, passes through the Tallahatta buhrstone and into the Wilcox sands. Only 60 feet of casing are used.

Well No. 197 was the second well bored in Meridian. The flow is said to be abundant, but the amount has never been measured. It is located near Okatibbee Creek, 6½ miles northwest of the courthouse and on much lower ground. Well No. 199 is the public well in one of the streets. A hydraulic motor pumps a small stream from this well, in which the water is chalybeate. The water from well No. 201 is a mineral water, but is distilled for making ice. The flow is ample for the purpose, some of the water being used for drinking supplies.

Wells Nos. 202 and 203, at Siding, obtain their supply from the buhrstone. The flow is greatly increased by drilling about 20 feet deeper than the buhrstone and putting in a longer strainer, as other wells in the vicinity also show.

Lawrence County.—The only formations outcropping in Lawrence County are the Grand Gulf clays and the overlying Lafayette. Pearl River crosses the entire county from north to south.

The water supply comes from both the Lafayette and the Grand Gulf, but the greater number of wells get their supply from the latter at a depth of 50 to 75 feet. The Grand Gulf water here, as at many other places, is hard, but is considered wholesome. No flowing wells are reported from this county.

Leake County.—Two shallow wells from the Lafayette are reported from Leake County. The Tallahatta buhrstone outcrops in the eastern part and furnishes a large amount of good water, but the supply has not been developed. Flowing wells are possible along Pearl River at moderate depths, particularly west of Carthage.

Lee County.—The Selma chalk forms the surface rock over the western and the Eutaw over the eastern part of the county. The slope of the surface is southeast, or about parallel to the strike of the strata. The artesian waters at Tupelo, Verona, Plantersville, and other places over the county come from the Eutaw sands, which outcrop in the hills to the east.

The first wells at Tupelo were drilled in the town and had a strong flow. Later, however, numerous wells along the near-by creek and at the United States fishery have been drilled at a lower elevation, and the water in the town wells has been lowered below the surface. Water is obtained in the United States fishery at a depth of 325 feet. There are six of these wells, which supply the water for the various fish ponds and for domestic use.

The water coming from the Eutaw contains more or less iron oxide, and where the Selma chalk is not cased off the water is high in lime carbonate. Where the wells are cased to the bottom the water is normally soft and wholesome.

Well No. 210 is near the eastern edge of the Selma chalk. The first water obtained at 125 feet rose to within 10 feet of the surface. The next horizon was at 250 feet and the water rose to within 3 inches of the surface. The last water was at 322 feet and flowed weakly.

Leflore County.—Leflore County borders the eastern edge of the Yazoo delta about halfway between Vicksburg and the Tennessee line. The highest altitude does not exceed 175 feet. In the adjacent county to the east the hills rise to a maximum height of 550 feet. The sands furnishing the strongly flowing wells in Leflore County come to the surface in the Carroll County hills and in those farther east. The conditions are thus very favorable for obtaining a large supply of flowing water. Leflore is one of the counties of the delta where the well drillers will guarantee a flowing well.

In well No. 217, at Greenwood, the first water was obtained at 340 feet, the next at 450, and a third at 600 feet, all of which are utilized by means of perforations in the pipe at the proper points. Hard rock, belonging perhaps to the Tallahatta buhrstone, was reported at a depth of 200 feet.

The following generalized section of the wells in and near Minter City was given by Mr. Feigler, a sucessful driller of this region: Subsoil 10 feet, sand and silt 100 feet, gravel 5 to 60 feet, sand 80 feet, soapstone and pipe clay interbedded with sand to the bottom of the wells, which range from 420 to 690 feet in depth. The quality of the artesian water from this county is considered excellent by those using it.

Below is a generalized section of the wells at Greenwood which receive their water from the Claiborne: Brown clay 20 feet, common sand 130 feet, coarse gravel 130 to 150 feet, gray sand 130 to 160 feet, fine "sea sand" 160 to 190 feet, gray sand 190 to 220 feet, soapstone or clay 220 to 300 feet, sand 300 to 380 feet, dark-brown hardpan 380 to 460 feet, and sand rock for about 20 feet, below which is a stratum of flint rock always about 8 inches thick. Water is found below this rock in dark-green sand.

Lincoln County.—This county, like Copiah, its northern neighbor, contains the elevated watershed between Pearl and Mississippi rivers, extending in a north-south direction near the center of the county. The uppermost bed of the Grand Gulf formation is here an impervious clay which checks the water collecting in the Lafayette and provides a fine supply of a soft, wholesome quality. Wells penetrating the compact clay of the upper Grand Gulf obtain abundant water at various horizons. No flowing wells are reported.

Lowndes County.—Tombigbee River approximately marks the division between the outcrop of the Eutaw sands and the Selma chalk. There are in Lowndes County 140 wells, 15 of which are in the city of Columbus. On the east side of the river they all flow, and on the west side they rise to a convenient pumping height. In the river valley it is necessary to bore only 200 to 300 feet for water. One well at Columbus 400 feet deep is reported to have a temperature of 70°.

Madison County.—Big Black and Pearl rivers form, respectively, the southeast and northwest boundaries of Madison County, and opposite Canton they approach within 16 miles of each other. The divide between the two rivers is quite narrow, with a long slope to the Big Black and a short steeper slope to the Pearl.

A large part of the county lies sufficiently low to have artesian wells. Flowing wells should be obtained anywhere along the Pearl River bottom on the east, and also along the Big Black at a maximum depth of 1,000 feet. At the same maximum depth flowing wells should be obtained anywhere along the Illinois Central Railroad north of Calhoun, with possibly the exception of Davis station, north of Canton.

The fine, wholesome water obtained in the Bolton well at a depth of 1,080 feet can be struck in southwestern Madison County at about 800 feet and less, and in many places it will rise to the surface. At the town of Canton good water was obtained at 460 feet which rose to within 40 feet of the surface. The water in the city waterworks well (No. 226), which is 1,020 feet deep, is called soft, but has a mineral taste and odor. Its temperature is 74°.

Marion County.—Artesian wells are easily obtained in Marion County along the low-lying land adjacent to Pearl River. There are a large number of wells, with an average depth of 425 feet, in and near the town of Columbia. The water is mineralized, containing sulphur, iron, and sodium, but it is considered soft and is used for domestic purposes.

Marshall County.—The high elevation of this county makes it impossible to get flowing wells, except perhaps along Tallahatchie River in the southeast corner. There is, however, an abundant water supply for all ordinary purposes in the Lafayette and the underlying Wilcox sands.

The Wilcox sands here are often unconsolidated and thus form a natural filter for the storm waters. On account of the porosity of the sand and the readiness with which the water sinks into the earth, care should be taken in locating wells in the towns and in places where the surface water is apt to become contaminated. Filtering water is not sufficient to remove from it the typhoid germs.

Monroe County.—The western part of Monroe County is underlain by the Selma chalk, the eastern half by the Tuscaloosa, and a narrow strip along Tombigbee River by the Eutaw. The highest part of the county is in the Tuscaloosa, which is the source of the artesian waters to the west. The water-bearing sands have a west to southwest dip of about 30 to 35 feet to the mile.

A well near Caledonia (No. 233) had a most remarkable flow, the water rising with such force that it was found impracticable to put down any casing. Enough sand and clay was washed out to obstruct Buttahatchie River. The well finally clogged itself and ceased to flow. Two others of like dimensions were bored by the same owner with similar results.

Flowing wells are obtained along the valley of the Tombigbee at a depth of about 300 feet. In the prairie region to the west the water rises to within 60 to 75 feet of the surface but does not flow.

Montgomery County.—The eastern part of Montgomery County marks the eastern border of the Tallahatta buhrstone. The hills, however, are not sufficiently high to get flowing wells over the western part of the county. There is a possibility of getting flowing wells in the southeastern part, along Big Black River.

The water from the deep wells in Winona is unusually pure and valuable for drinking purposes and for use in boilers. The following interesting log of one of these deep wells (No. 235) was kept by Mr. R. A. Allison:

Log of deep well in Winona, Miss.

	Feet.
Soil and clay	25
Orange-colored sand	10
"Blue marl"(?)	40
Lignite	5
Quicksand	15
Black clay	50
Coarse sand and fair supply of water	10
Lignite	10
"Blue marl" (?)	35
Fine sand	15
Clay	10
Quicksand	60
Clay	40
Fine sand, coarse on top	25
Brown clay	35
Coarse, water-bearing sand, with gravels at top	27
Total depth	412

The temperature of the water is 65° F. The 50-foot bed of black clay beginning at a depth of 95 feet below the surface is the heavy bed of black clay at or near the top of the Wilcox. At the town of Grenada, 24 miles north of Winona, the black clay shows in the bank of Yalobusha River. At the top of the high hill 4 miles west of Grenada the hard quartzitic sandstone of the Tallahatta forms the cap rock. The same Tallahatta buhrstone is found in the hills west of Vaiden. The heavy bed of black clay coming at or near the top of the Wilcox can be traced from Winona, Miss., in well sections and outcrops to Memphis, Tenn.

Neshoba County.—No artesian wells have been reported in Neshoba County. Good shallow-well water is obtained in the Lafayette, while water at a greater depth may be had at the base of the Claiborne in the southwestern part of the county.

Newton County.—There are five different geologic formations represented in Newton County. The Wilcox and Tallahatta buhrstone are in the northeastern portion, the Lisbon beds in the center, and the Jackson calcareous clays in the southwest. The Lafayette overlies all these formations.

There are a number of flowing wells in the southeast corner along Chickasawhay River, which obtain their supply from the buhrstone. At the town of Chunkey the wells are cased only to the buhrstone, which in well No. 238 was at 16 feet.

An analysis of the water from well No. 242, at Hickory, shows the principal mineral ingredients to be sodium, calcium, and magnesium bicarbonates, but the water is not decidedly alkaline.

Noxubee County.—The greater part of the surface of Noxubee County is a rolling prairie sloping southeastward to Tombigbee River. Flowing wells are obtained along the valleys of Tombigbee and Oaknoxubee rivers. Over the remaining part of the Selma prairie water will rise to within good pumping distance of the surface. Mr. Ladd, of Macon, who has been in the well business for fifty years, reports that water will in general rise to an altitude of 218 feet above sea level in this region. The dip of the beds is reported to be 25 feet to the mile southwestward.

The water from well No. 249, at Macon, is alkaline and gives trouble in the boilers if used when fresh, but after standing it can generally be used.

There are three wells (No. 250) on the farm of Mr. Dent, 10 miles east of Macon, which average 650 feet in depth, and nearly every plantation has one or more.

Oktibbeha County.—The western border of the Selma prairies is in the central part of this county. The Porters Creek clays and Wilcox formation come to the surface in the western half. The Lafayette covers but a small part, chiefly in the west. The great thickness of the Selma, which is barren of water, makes it difficult to get good water. Artesian water is obtained in the northeast corner at a depth of about 300 feet. At Starkville, 11 miles southwest of Muldrow, water is obtained at a depth of 900 feet, which shows a westward dip of the strata of 33 feet to the mile. The water in the Starkville well (No. 253) rises to within 130 feet of the surface.

Well No. 254, at the Agricultural and Mechanical College, has a 100-foot Cook strainer. The first water was from a 50-foot bed of sand, beneath which is a stratum of clay 10 feet thick, and a layer of sand 35 feet thick. The strainer extends through both water-bearing strata.

Panola County.—The high hills of the Wilcox formation occupy the eastern part of Panola County, and the low-lying Port Hudson sands and clays the western part. The source of the artesian water is the Wilcox sands, which outcrop in the hills east of Oxford. The Port Hudson here, as at all other places in the Yazoo Delta, furnishes a large supply of impure surficial water.

The only flowing wells reported are in the town of Batesville. The city well (No. 255) flows a strong stream of water which has stained the pipe and trough with iron oxide. It is used for general domestic purposes and is considered a wholesome drinking water.

Pearl River County.—The population of this county is very small and the water resources are undeveloped.

Perry County.—Perry is one of the few counties of southern Mississippi, except the Gulf coast counties, which have artesian wells. A large number of flowing wells, ranging in depth from 325 to 380 feet, have been drilled in and near Hattiesburg. Very little effort has been made to get flowing wells in other portions of the county. In the eastern part, along Leaf River and its northern tributaries, flowing wells should be obtained at about the same horizon as those at Hattiesburg.

The town of Hattiesburg is supplied with water from flowing wells, one 4 inches and another 6 inches in diameter, the water being pumped from a reservoir through the town. This water is alkaline and chalybeate.

Pike County.—In the greater part of this county the Lafayette lies deep on the Grand Gulf clays. Wherever the former is cut through by erosion large springs occur.

Pontotoc County.—The uppermost formation of the Cretaceous comes to the surface in the eastern part of Pontotoc County, and the lower Tertiary appears in the west. The Ripley sands are water bearing. Along the headwaters of Tallahatchie River, in the north-central part, flowing wells are obtained. Over the remainder of the county the elevation of the country lying west of the catchment area of the Ripley sands is too great to get flowing wells, except, perhaps, along the headwaters of Shooner River, in the southwestern part.

Efforts have been made to get flowing wells at the town of Pontotoc, but without success. It should be remembered that this town is located on the crest of Pontotoc Ridge, the northern extension of which is the source of the flowing wells in the vicinity of Ecru. Pontotoc is more than 100 feet higher than Ecru, where the water rises only to the surface. It is very improbable, therefore, that flowing water could be obtained at Pontotoc. Considering the dip of the underlying Cretaceous to be constant, good pumping water from the Tuscaloosa-Eutaw horizon may be expected at a depth of 893 feet, and it should rise to within 250 feet of the surface. The same water in the southern part of the county would be obtained at a still greater depth.

Prentiss County.—The high east-west ridge across this county makes it impossible to get flowing wells anywhere within it. Good pumping water could be obtained from the Tuscaloosa sands, at a maximum depth of 500 feet, in the vicinity of Booneville. The water would rise to within about 260 feet of the surface, and perhaps less, depending on the elevation of the catchment area to the east.

Quitman County.—The Wilcox sands, which furnish the flowing wells at Batesville, continue their westward dip of about 16 feet to the mile, and in Quitman County the wells range in depth from 636 to 860 feet. One well furnishes 100 gallons per minute from a 2½-inch pipe. One of the deep wells at Riverside (No. 278) has the following interesting log:

Log of well at Riverside.

	Feet.
9. Sand and silt	40
8. Blue mud	45
7. Water-bearing sand	50
6. Gravel sand	40
5. Soapstone alternating with sand	220
4. Rock	1
3. Soapstone and rock	50
2. Green sand to lignite which is 10 inches thick	10
1. Soapstone containing mica and white sand	180
Total depth	636

Nos. 1 to 5, inclusive, are strata in the Wilcox, while the upper 175 feet belong to the Port Hudson formation. The 370 feet represented by Nos. 3, 4, and 5 are the upper clay of the Wilcox, which is shown in the Memphis well and outcrops in the river bed at Grenada.

Rankin County.—Flowing wells are not possible in this county, except along Pearl River. Wells in the southern part of the county are supplied from the Grand Gulf formation. The water is often strongly mineral, as it comes from lignitic clays and sands. Strong springs are common in the western part of the county. Some of these spring waters are hauled to Jackson in large demijohns and sold for drinking water.

Scott County.—About half of this county is prairie land of the Jackson formation. The town of Forest is in a belt of level land or "flat woods," 5 to 10 miles wide, running from the southeast to the northwest corner of the county. When water is found in this prairie soil it is very unsatisfactory for drinking, as it contains a large amount of lime. At Forest one well is reported to be 520 feet deep. This failed during the fall of 1903 and a new one was drilled later. Here and there over the prairie are hills and ridges covered with remnants of the Lafayette, which furnish excellent water in shallow wells and springs. Good deep-well water can be obtained from the Claiborne horizon at 500 to 700 feet. In some sections of the county the water will rise very near the surface.

Sharkey County.—No wells are reported. Flowing wells are not to be obtained. Good wholesome water from the Claiborne horizon would be reached at about 1,500 feet.

Simpson County.—Water is obtained from the Grand Gulf and the Lafayette. Flowing wells could doubtless be obtained along Pearl River at a maximum depth of 500 feet.

Smith County.—The elevation is high and the water is poor in the northern part of the county. Flowing wells from the lower Grand Gulf are obtained in the southeastern part, in the vicinity of Taylorsville. The deepest (No. 281) in the county has a depth of 1,135 feet. The strata passed through are as follows (no thicknesses are given): Surface clay, sand, blue sand mixed with sand, sand rock, blue mud, and sand. Water was obtained in white sand.

Sunflower County.—Only two wells have been reported from Sunflower County. The temperature of the Moorhead well (No. 287) is 60° (?). The Claiborne horizon lies at a depth of more than 1,000 feet in the western part of the county, and the water will not generally rise above the surface. In eastern Sunflower County it is possible to get good flowing wells at about 900 to 950 feet. In boring for water a depth of 900 feet on the eastern border of the county should be counted on, with an additional 25 feet for each mile to the west.

Tallahatchie County.—This county, like Leflore County, which lies just south of it, has high hills in the adjoining county to the east. Drillers say that it is more difficult to obtain flowing wells in Tallahatchie than in Leflore County. This is perhaps due to two causes. The artesian water in Leflore comes from the Claiborne horizon, while that in Tallahatchie comes from the Wilcox. There is also a possibility that the water-bearing sands underlying Tallahatchie County may be much finer and mixed with clay, which would make the water horizon less certain.

Tate County.—No artesian wells are found in Tate County. The wells in the eastern edge of the Yazoo Delta in this county along Coldwater River have the following general section: Surface clay 15 to 20 feet, gravel 12 to 15 feet, red sand merging into white sand, below which come pipe clay and water-bearing sand. East of the delta good shallow wells and springs are found at the base of the Lafayette.

Tippah County.—The eastern part of Tippah County has a north-south line of high hills in which the Ripley formation outcrops. This formation furnishes fine water, which has not been found to rise above the surface. There is a possibility of getting flowing wells on Tippah Creek, in the western part of the county.

The outcrop of the Midway limestone is marked by a line of springs, the water of which is chalybeate. It obtains its iron in passing through the sandy marl lying above the limestone.

Tishomingo County.—This county contains numerous springs along the contact of the older Devonian and Carboniferous rocks with the lower Cretaceous. The Iuka Springs are noted for their curative properties.

Tunica County.—Flowing wells can be obtained in the eastern half of Tunica County at a maximum depth of 875 feet. The water will probably not rise above the surface along the western border, but will reach within an easy pumping distance.

Union County.—Central Union and north-central Pontotoc counties contain a small area of artesian wells. The source of the water is the lower Ripley sands on the west slope of Pontotoc Ridge, in the eastern part of these counties. The catchment area of the Ripley is comparatively limited, and the head of the water has been considerably lowered by increasing the number of wells. The first wells at New Albany had a very high pressure, but most of them now have to be pumped. Water is generally reached at a depth of less than 250 feet.

Warren County.—Only one deep well is reported from Warren County. This is the Vicksburg well, which is 1,060 feet deep, and in which, when it was completed, the water rose to the surface. Wells south of Vicksburg obtain their supply from the Grand Gulf and the Lafayette; those north of the town from the Lafayette only.

Washington County.—No flowing wells are reported from Washington County. The western part is too far removed from the sources of the water to obtain flowing wells, but artesian wells should be obtained in the eastern part at a maximum depth of 1,200 feet and perhaps less. Flowing wells are obtained at Tchula, in central Holmes County at a depth of about 770 feet. If we assume a westward dip of 25 feet per mile, the same water can be reached at Belzona at about 1,150 feet.

The following log was given of the deep well (No. 307) at Leland. This well is 512 feet in depth and rises to within 14 feet of the surface.

Log of deep well at Leland.

	Feet.
Buckshot clay	2
Fine sand	138
Hard gravel	14
Hard blue clay	298
Coarse gray sand	60
	512

Water was obtained in the last 60 feet of sand. In the 298 feet of hard clay there were six different strata of rock from 6 inches to 2 feet thick. The driller reports that these rock strata are persistent over this region of the Yazoo Delta. In some wells ten or twelve different strata are found, and in others not more than three or four. The maximum thickness of these rocks is 4 feet. The driller further says that the hard gravel is very persistent, is always found at about the same depth, and is never less than 10 nor more than 14 feet thick. The water carries 9 grains of solid matter to the gallon, 7 grains being soda.

Wayne County.—There are numerous flowing wells along Chickasawhay River in Wayne County. The water comes from the Claiborne horizon and is usually red and of an alkaline character.

Well No. 309, at Waynesboro, yields red water, which contains 72 grains of sodium carbonate to the gallon and considerable iron. All the wells at Waynesboro start in a thin sandy layer, possibly Lafayette, which rests upon the Vicksburg, and reach the lower Lisbon beds, from which they obtain red water.

Webster County.—No deep wells are reported. Water is supplied from shallow wells.

Wilkinson County.—No deep wells are reported. Water is supplied from shallow open wells.

Winston County.—Plenty of water is obtained from the Wilcox, but at many localities it is very bad, owing to the great amount of lignitic clay.

Yalobusha County.—There are two artesian areas in Yalobusha County, one in the vicinity of Coffeeville and the other at Water Valley, but there are, no doubt, other undeveloped areas along the lower streams. The source of the artesian water at the above-mentioned places is the lower division of the Wilcox.

There are eight flowing wells in the town of Coffeeville and three others near the city limits. They range in depth from 160 to 400 feet. The log of well No. 315 showed 40 feet of surface sand; 100 feet of greensand; then gravel, lignite, and sand to water, which was obtained at 238 feet. Where the water-bearing sand was encountered, the drill dropped 8 or 9 feet into it. This is a white sulphur water and is said to be wholesome.

Wells are easily obtained in Shooner River Valley, and the drillers guarantee a flowing well at a cost of $100.

Yazoo County.—One of the deepest wells (No. 319) in the State was recently drilled at Yazoo. It failed to get flowing water at a depth of 1,567 feet, though there are flowing wells in the town of less than half that depth. The temperature of one of the flowing wells southwest of town is reported to be 70° F.

DEEP-WELL RECORDS

Partial list of deep wells

[Reported to the United

No.	County.	Town.	Owner.	Location. Township.	Range.	Section.	Year completed.	Diameter of well.	Depth of well.	Depth to principal water supply.	Height of water above (+) or below (−) mouth of well.
								In.	*Feet.*	*Feet.*	*Feet.*
*1	Adams	Natchez	Waterworks Co				1901	6	340		− 30
*2	do	do	Oil mills					6	170		− 20
3	do	do	Gas Company					6	165		− 10
*4	do	do	Electric Light, Heat and Power Co.					6	430		−160
5	do	do	C. S. Bennett				1899	10	115	115	− 85
6	do	do	Cotton mills No. 2				1902	8	175		− 8
7	do	do	Natchez ice factory				1902	6	517	500	− 8
8	do	do	do				1902	6	300	264	− 36
*9	do	Pine Ridge	W. P. Henderson				1896	6	97	85	− 85
*10	Alcorn	Corinth	E. S. Candler	2	2	7	1900	6	100	100	− 20
*11	do	do	Waterworks Co				1903	12	345		− 20
*12	Attala	Kosciusko	A. M. Hanna	14	7	21	1899	4½	276	200	− 76
13	Bolivar	Cleveland	Sillers & Owens	22	5	21	1901	3	1,000	1,000	+ 0
14	do	do	C. S. Glassco	22	5	21	1901	4	1,000	1,000	+ 0
15	do	O'Reilly	O'Reilly	21	5	23	1901	4	1,002		+ 0
16	Carroll	Carrollton	A. H. George	19	4	6	1898	8	85	70	− 70
*17	do	do	City				1900	4	1,250	300 450	−
*18	do	do	Waterworks Co	19	3		1900	4	400	400	+ 0
19	do	Vaiden	S. E Turner	17	5		1901	2	105	105	+ 12
*20	Chickasaw	Okolona	City				1899	6	550	550	− 80
*20a	do	do	Mobile and Ohio Railroad.						548	473	− 22
21	Choctaw	Chester	J. T. McCafferty	18	10	15	1892	10	86	80	− 60
*21a	Claiborne	Hermanville	W. G. Herrington	11	4	3	1878	12	86	75	− 75
*22	Clarke	Barnett	A. Krouse	2	14	20	1899	4	350	125	−
*23	do	do	Smith's Mill Co	2	14	31	1902	6	600		−
*24	do	De Soto	Town	2	15	36	1898	3	190	150	+ 3
*25	do	Enterprise	do	4	14	24	1895	2	156	150	+ 20
*26	do	do	R. M. Buckley	4	15	19	1896	3	198		− 2
27	do	do	John Kemper	4	14	26	1901	3	150	150	+ 15
28	do	do	Bonny	4	14	23	1901	3	200		+ 10
*29	do	do	S. J. Taylor	4	14	23	1900	3	210	210	− 3
30	do	do	Mrs. O'Ferral	4	15	19	1900	3	400	210	− 20
*31	do	Quitman	J. B. Evans	2	15	1	1898	3	232	232	+ 15
32	do	do	Mississippi Lumber Co.	2	15	2	1899	3	179	179	+ 20

* See text, pp. 27-29, for additional data.

'N MISSISSIPPI.

in the State of Mississippi.

States Geological Survey.]

How obtained at surface.	Quality.	Supply per minute.	Increase or decrease of supply.	Effect of pumping on level of water.	Geologic horizon of well mouth.	Geologic horizon of principal water-bearing stratum.	No.
		Gals.					
Pump	Hard		None apparent.	None apparent.	Lafayette	Grand Gulf	*1
do	do		Neither	do	Loess	Base of Lafayette	*2
do			do		do	Lafayette	3
do			None apparent.		do	Grand Gulf	*4
Bucket	Good		Neither		do	Lafayette	5
Pump	Hard		do	Little	do	Grand Gulf	6
do	do	50	None apparent.	None apparent.	Lafayette	do	7
Compressed air.	Good	70	do	do	do	do	8
Bucket	Hard			Easily lowered.	Loess	Lafayette	*9
Pump	do		None apparent.	None apparent.	Lafayette	Eutaw	*10
do	do	20	do	do	do	Tuscaloosa	*11
do	do	100	do	Little	Claiborne	Wilcox	*12
Flows	Soft	75	None		Port Hudson.	do	13
do	do	100	None apparent.	None apparent.	Alluvial bottom.	Claiborne	14
do	do	100	None		Port Hudson.	Wilcox	15
Bucket	do		None apparent.				16
		0			Lafayette?	Claiborne	*17
Flows	Soft	62	None apparent.		Alluvial bottom.	do	*18
do	do		Neither				19
Compressed air.	do	138	None apparent.	None apparent.	Cretaceous	Eutaw	*20
Pump					Lafayette	do	*20a
Pulley	Hard	½	do	Easily lowered.	do	Wilcox	21
Bucket				None	do	Grand Gulf	*21a
None					Jackson	Claiborne	*22
do					do	do	*23
Flows	Soft, alkaline.	⅓	Decreased		Claiborne	do	*24
do	Soft	15	Slight		Alluvial soil	Wilcox	*25
Pump	do		Decreased	Lowers easily.	Lafayette	do	*26
Flows	do		Little		Alluvium	do	27
do	do		do		Lafayette	do	28
Pump	do		Decreased slightly.	Slight	do	do	*29
do	do		Decreased	Easily lowered.	do	do	30
Flows	do	3	Variable	do	do	do	*31
do	do	3		do	do	do	32

DEEP-WELL RECORDS

Partial list of deep wells

No.	County.	Town.	Owner.	Location. Township.	Location. Range.	Location. Section.	Year completed.	Diameter of well.	Depth of well.	Depth to principal water supply.	Height of water above (+) or below (−) mouth of well.
								In.	*Feet.*	*Feet.*	*Feet.*
*33	Clarke	Quitman	Town	2	15	1	1898	3	175	175	+ 15
*34	do	Shubuta	do				1898	2	400		+ 15
*35	do	do	Weems				1901	2	422	400	+ 20
36	do	do	W. P. Cooper				1902	6	420	375	+ 30
37	do	do	W. H. Paterson				1900	2	400	400	+ 20
38	do	do	F. H. Floyd				1901	2	400	400	+ 20
39	do	do	D. C. Ward				1902	2	170		+ 10
40	do	do	W. P. Cooper				1900	2	165		+ 0
41	do	do	Moseley				1901	2	175	160	+ 10
42	do	do	Patterson				1901	2	160		+ 10
*43	do	do	Cooper's mill				1897	2	145		− 20
44	do	do	Stovall				1900	2	165		+ 15
*45	do	do	A. Johnston	1	16	25	1896	2	280	260	+ 20
46	do	do	Eggerton				1900	2	175		+ 10
47	do	do	Floyd Hotel				1899	2	165		+ 10
48	do	do	Poole & Brown				1900	2	175		+ 10
49	do	do	Brown's mill				1901	2	165		+ 10
50	do	do	Leggett				1902	2	170		+ 10
51	do	Stonewall	T. L. Wainwright	3	15E	5	1897	2½	300	250	+ 20
*52	Clay	West Point	City				1895	3	600	600	+ 1
*52a	do	Cedar Bluffs	do						650	650	−100
53	Coahoma	Eagles Nest	James L. Alcorn's estate.	28	3	22	1898	1½	825	825	+ 0
*53a	do	Clarksdale	Town.				1897	2½	876	876	+ 10
54	do	Jonestown	Geo. Richberger	28	6		1902	2	800	700	+ 0
*55	do	Lyon	Lamar Fontaine	27N	3 W	18	1901	4	975	970	+ 35
*56	Copiah	Wesson	Dr. E. A. Rowan	9	8E	34	1890	36	120	120	−100
*56a	Grenada	Grenada	City						620	490	+ 0
*57	Hancock	Bay St. Louis	College				1888	3	738		+ 42
*58	do	do	do				1892	3	750		+ 42
*59	do	do	R. E. Craig				1901	3	529		+ 17
*60	do	do	G. W. Dunbar Sons' Co.				1888	2	250		+ 20
*61	do	do	do				1898	3	338		+ 35
*62	do	do	Dr. F. Loeber				1890	3	669	656	+ 40
*63	do	do	McClyde Turpentine Co.				1903	3	328		+ 25

* See text, pp. 28–30, for additional data.

IN MISSISSIPPI—Continued.

in the State of Mississippi—Continued.

How obtained at surface.	Quality.	Supply per minute.	Increase or decrease of supply.	Effect of pumping on level of water.	Geologic horizon of well mouth.	Geologic horizon of principal water-bearing stratum.	No.
		Gals.					
Flows	Soft	3	Variable		Lafayette	Wilcox	*33
do	do	20	Decreased		Jackson	Claiborne	*34
do	do		None apparent.		Jackson	Claiborne	*35
do	do	40	do		do	do	36
do		40	do		do	do	37
do	Soft	40	do		do	do	38
do	do	15	do		do	do	39
do	do	15	Decreased slightly.		do	do	40
do	do	15	None apparent.		do	do	41
do	do	15	do		do	do	42
	do	20	do		do	do	*43
Flows	do	10	do		do	do	44
do	do	15	Decreased		do	do	*45
do	do	10	None apparent.		do	do	46
do	do	10	Slight decrease.		do	do	47
do	do	10	None apparent.		do	do	48
do	do	10	do		do	do	49
do	do	15	do		do	do	50
do	do	25	Decreased 25 per cent.		Lafayette	Wilcox	51
do	Best		None apparent.		do	Tuscaloosa	*52
					Selma	do	52a
Flows	Soft	8	None apparent.		Alluvium?	Wilcox	53
do	do	3	do		do		*53a
do	do	8	do		River bottoms.	Wilcox	54
do	do	22	do		Port Hudson	do	*55
Pump	Hard		Neither	Slight	Lafayette	Grand Gulf	*56
Flows					do	Wilcox	*56a
do	Soft	8	Decreased		Post-Tertiary.		*57
do	do	5	do		do		*58
do	do	100	None apparent.		do	Post-Tertiary	*59
do	do	35	do		do	do	*60
do	do	100	do		do	do	*61
do	do	40			do		*62
do	do	20	None apparent.		do	Post-Tertiary	*63

DEEP-WELL RECORDS

Partial list of deep wells

No.	County.	Town.	Owner.	Location. Township.	Location. Range.	Location. Section.	Year completed.	Diameter of well.	Depth of well.	Depth to principal water supply.	Height of water above (+) or below (−) mouth of well.
								In.	*Feet.*	*Feet.*	*Feet.*
*64	Hancock	Bay St. Louis	Chas. Sanger				1892	3	385	385	+ 15
*65	do	do	do				1889	3	384	361	+ 30
*66	do	do	St. Stanislaus College.				1888	2	420	190 420	+ 20
*67	do	do	St. Joseph's Academy.				1888	2	418	418	+ 20
68	do	do	R. Thelhiard				1893	2½	345	315	+ 13
*69	do	do	Tally Lumber Co.				1903	4½	150		+ 23
70	do	Logtown	Bush & Johnson				1889	2½	620		+ 25
*71	do	Nicholson	D. Carver	6	17	34	1896	2	250	225	+ 0
72	do	Picayune	J. W. Simmons	6	17	15	1895	2	500	500	+ 25
*73	do	Waveland	P. Helwig				1891	2½	356		+ 15
*74	do	do	Mr. Bookta					3	366	320	+ 0
*75	do	do	A. Matranger				1894	3	438	419	+ 15
*76	do	do	F. Caseneuve					3	376	357	+ 15
77	do	do	M. A. Dauphin				1889	2½	483	467	+ 23
*78	do	do	T. R. Fell				1888	2½	461	410	+ 20
79	do	do	Paul Conrad				1889	3	432	412	+ 16
80	Harrison	Biloxi	Barataria Canning Co.				1886	3	620		+ 75
81	do	do	Biloxi Canning Co.				1902	3	715		+ 65
82	do	do	Biloxi Cemetery				1896	2½	580		+ 35
83	do	do	Biloxi Ice Co.				1894	3½	920		+ 75
84	do	do	Jno. Caraway				1896	2½	560		+ 30
85	do	do	Mrs. Carter				1896	2½	600		+ 30
86	do	do	City				1889	2½	420		+ 25
87	do	do	do				1889	2	414		+ 20
88	do	do	do				1889	4½	860		+ 80
89	do	do	F. H. Dunbar				1891	2	420		+ 20
90	do	do	Thos. Gill				1895	3	720		+ 70
91	do	do	H. Howard				1885	2	420		+ 25
92	do	do	F. T. Howard				1885	2½	415	400	+ 30
93	do	do	do				1886	4½	920		+ 80
94	do	do	do				1886	2½	420	410	+ 30
95	do	do	Ice factory					3½	890		+ 80
96	do	do	E. C. Joullian				1901	2½	650		+ 60
97	do	do	L. Lopez				1886	2	600		+ 27
98	do	do	do				1886	2½	620		+ 60
99	do	do	do				1897	3	700		+ 70
100	do	do	J. H. Keller				1886	2½	420		+ 30
101	do	do	Waterworks Co.					4½	860		+ 53
101a	do	Bond	J. E. North						690	530	−160

*See text, pp. 30-31, for additional data.

IN MISSISSIPPI—Continued.

in the State of Mississippi—Continued.

How obtained at surface.	Quality.	Supply per minute.	Increase or decrease of supply.	Effect of pumping on level of water.	Geologic horizon of well mouth.	Geologic horizon of principal water-bearing stratum.	No.
		Gals.					
Flows	Soft	5	Fluctuates		Post-Tertiary.		*64
do	do	30	None apparent.		do		*65
do	do	40	do		do	Post-Tertiary	*66
do	do	40	do		do	do	*67
do	do	45	do		do		68
do	do	100	do		do	Post Tertiary	*69
do	do	60	do		do	Grand Gulf	70
do	do	28	Neither		Port Hudson	Grand Gulf	*71
do	do	27	do		Post-Tertiary.		72
do	do	25	None apparent.		do		*73
do	do	75	do		do		*74
do	do	30	do		do		*75
do	do	30	do		do		*76
do	do	25	do		do		77
do	do	30	do		do		*78
do	do	30	do		do		79
do	do	150	do		do		80
do	do	125	do		do		81
do	do	70	do		do		82
do	do	300	do		do		83
do	do	70	do		do		84
do	do	60	do		do		85
do	do	50	do		do		86
do	do	35	do		do		87
do	do	425	do		do		88
do	do	40	do		do		89
do	do	150	do		do		90
do	do	50	do		do		91
do	do	40	do		do		92
do	do	175	do		do		93
do	do	50	No change		do		94
do	do	300	None apparent.		do		95
do	do	100	do		do		96
do	do	50	do		do		97
do	do	100	do		do		98
do	do	175	do		do		99
do	do	60	do		do		100
do	do	450	do		do		101
do	do		do		do	Grand Gulf	101a

DEEP-WELL RECORDS

Partial list of deep wells

No.	County.	Town.	Owner.	Location. Township.	Range.	Section.	Year completed.	Diameter of well.	Depth of well.	Depth to principal water supply.	Height of water above (+) or below (−) mouth of well.
								In.	*Feet.*	*Feet.*	*Feet.*
*102	Harrison	Delisle	W. S. Keel	8	13	2	1898	2	380		+25
103	do	Gulfport	U. S. Marine Hospital, Ship Island.				1900	3	760		+50
104	do	do	Ice factory				1891	2½	540		+25
105	do	do	Chautauqua Circle				1891	3	680		+50
106	do	do	G. & S. I. R. R				1896	2½	680		+25
107	do	do	do				1899	3	920		+75
108	do	do	do				1903	4½	960		+80
109	do	Handsboro	—— Zimmerman				1896	2½	500		+15
110	do	do	H. Leinhard				1896	2½	700		+20
111	do	do	Leonard Lumber Co.	7	11	25	1895	3	700		
*112	do	Howison	Howison Lumber Co.				1897	2	1,480	1,400	−35
113	do	Longbeach	F. Jahenski				1896	2½	580		+25
114	do	do	—— McCaughn				1897	2½	600		+35
114a	do	Lyman	City						480	375	
115	do	Mississippi City.	F. W. Elmer				1896	4½	860	850	0
116	do	do	L. & N. R. R				1885	2	520		+20
117	do	do	Mr. Clemaceau				1897	3	740		+80
118	do	do	C. P. Ellis				1896	3	720		+75
119	do	do	Mr. De Buys				1895	2½	640		+30
120	do	do	Mr. Soria				1885	2	514		+20
121	do	Nugent					1902	2½	300	300	+30
*122	do	Pass Christian.	R. M. Walmsley				1902	3	720		+50
*123	do	do	Wm. Hardin				1892	3	620		+47
*124	do	do	C. L. Chaptal				1892	2½	543		+25
*125	do	do	A. Swanson				1892	2½	560		+30
*126	do	do	E. Saunders				1884	2	575		+25
*127	do	do	City				1885	2	420		+30
*128	do	do	do				1887	2½	520		+35
*129	do	do	do				1893	2	620		+30
*130	do	do	do				1890	3	640		+50
*131	do	do	do				1890	3	625		+60
*132	do	do	do				1890	3	840		+80
*133	do	do	G. H. Taylor				1898	2	420		+27
*134	do	do	do				1898	3	725		+80
*135	do	do	E. Connery, jr				1886	2	520	510	+35
*136	do	do	L. C. Tallon				1901	3	640		+40
*137	do	do	A. Mullinburger				1888	2½	514		+40

* See text, p. 31, for additional data.

?? MISSISSIPPI—Continued.

? *the State of Mississippi*—Contiuued.

How obtained at surface.	Quality.	Supply per minute.	Increase or decrease of supply.	Effect of pumping on level of water.	Geologic horizon of well mouth	Geologic horizon of principal water-bearing stratum.	No.
		Gals.					
Flows	Soft	25	None apparent.		Post-Tertiary.	Lafayette	*102
do	do		do		do	Grand Gulf	103
do	do	60	do		do		104
do	do	80	do		do		105
do	do	60	do		do		106
do	do	150	do		do		107
do	do	175	do		do		108
do	do	60	do		do		109
do	do	100	do		do		110
do	do	175	Variable		Alluvium	Pascagoula	111
		0					*112
Flows	Soft	60	None apparent.		Post Tertiary.		113
do	do	70	do		do		114
					do	Grand Gulf	114a
Flows	Soft	450	None		do	do	115
do	do	50	None apparent.		do		116
do	do	160	do		do		117
do	do	150	do		do		118
do	do	70	do		do		119
do	do	50	do		do		120
do	do	60	do				121
do	do	150	do		Post Tertiary.		*122
do	do	170	Little		do		*123
do	do	60	do		do		*124
do	do	70	do		do		*125
do	do	60	do		do		*126
do	do	40	do		do		*127
do	do	50	do		do		*128
do	do	40	None apparent.		do		*129
do	do	150	do		do		*130
do	do	150	do		do		*131
do	do	225	do		do		*132
do	do	25	do		do		*133
do	do	200	do		do		*134
do	do	60	None		do	Grand Gulf ?	*135
do	do	80	None apparent.		do		*136
do	do	50	do		do		*137

DEEP-WELL RECORDS

Partial list of deep wells

No.	County.	Town.	Owner.	Location. Township.	Location. Range.	Location. Section.	Year completed.	Diameter of well.	Depth of well.	Depth to principal water supply.	Height of water above (+) or below (−) mouth of well.
								In.	*Feet.*	*Feet.*	*Feet.*
*138	Harrison	Pass Christian.	W. R. Wilson	....	....	....	1898	2½	510	......	+ 25
*139	....do	....do	Mrs. Watt	....	....	....	1896	3	670	......	+ 75
*140	....do	....do	E. Connery, sr.	....	....	....	1887	2½	510	......	+ 50
*141	....do	....do	Jno. Curran	....	....	....	1894	3	620	......	+ 40
*142	....do	....do	Jno. A. Sutter	....	....	....	1894	2½	514	......	+ 45
*143	....do	....do	S. F. Heaslip	....	....	....	1895	2½	620	......	+ 40
*144	....do	....do	E. Hocaday	....	....	....	1895	2	520	......	+ 30
*145	....do	....do	Mexican Gulf Hotel	....	....	....	1888	2½	520	......	+ 30
*146	....do	....do	J. H. Menge	....	....	....	1890	2½	600	......	+ 30
*147	....do	....do	H. Buddig	....	....	....	1889	2½	600	......	+ 25
*148	....do	....do	J. M. Ayer	....	....	....	1891	2	540	......	+ 25
*149	....do	....do	....do	....	....	....	1891	2	540	......	+ 25
*150	....do	....do	Pass Packing Co	....	....	....	1899	3	920	......	+ 80
*151	....do	....do	Doctor Perault	....	....	....	1903	3	1,020	......	80
*152	....do	....do	Magnolia Hotel	....	....	....	1902	3	900	......	+ 89
*153	....do	....do	H. Payne	....	....	....	1890	2½	614	......	+ 30
153a	....do	Ship Island	Gov. light-house	....	....	....	......	2	750	700	+
154	....do	Saucier	Biloxi Lumber and Export Co.	....	....	....	1897	3	720	......	......
155	....do	Wortham	J. C. Wilmoth	6	12	1	1902	4	836	786	+ 15
156	Hinds	Jackson	Ice factory	....	....	....	1896	6	604	......	− 58
157	....do	....do	Baptist Orphanage	....	....	....	1900	6–4½	200	180	−120
*157a	....do	Bolton	City	....	....	....	1903	6	1,517	1,020	− 80
158	Holmes	Durant	I. C. R. R	....	....	....	......	5	375	......	+ 0
158a	....do	....do	City	....	....	....	1905	6	500	500	+ 1
158b	....do	Cruger	Ed. Archer	17	1	26	1897	2	800	700 and 800	+
158c	....do	Lexington	G. A. Wilson	....	....	....	....	2	800	......	+
*159	....do	Pickens	W. S. Gordon?	12	3	15	1901	4–2	265	265	+ 2
*160	....do	Tchula	City	....	....	....	1900	4–2	1,125	......	+ 85
161	....do	....do	W. B. Jones	16	1	5	1902	3–2	770	770	......
*162	....do	West	Dr. L. S. Rogers	15	5	3	1901	3	160	150	+ 15
*163	Jackson	Fontainebleau	J. B. Carson	....	....	....	1893	2½	720	700	+ 50
*164	....do	....do	A. E. Lewis	....	....	....	1889	2½	625	600	+ 40
165	....do	Moss Point	Dantzler Lumber Co.	....	....	....	1889	2½	560	......	+ 25
*166	....do	....do	Denny Lumber Co	....	....	....	1902	3	900	......	+ 20
*167	....do	....do	F. H. Lewis	....	....	....	1902	6–4	1,550	650	+ 50

* See text, pp. 31–33, for additional data.

" MISSISSIPPI—Continued.

n the State of Mississippi—Continued.

How obtained at surface.	Quality.	Supply per minute.	Increase or decrease of supply.	Effect of pumping on level of water.	Geologic horizon of well mouth.	Geologic horizon of principal water-bearing stratum	No.
		Gals.					
Flows	Soft	60	None apparent.		Post Tertiary.		*138
do	do	170	Little		do		*139
do	do	50	None apparent.		do		*140
do	do	100	do		do		*141
do	do	60	do		do		*142
do	do	70	do		do		*143
do	do	50	do		do		*144
do	do	60	do		do		*145
do	do	60	do		do		*146
do	do	50	do		do		*147
do	do	50	do		do		*148
do	do	50	do		do	Post-Tertiary	*149
do	do	250	do		do		*150
	do	250	do		do		*151
Flows	do	250	do		do	Pascagoula marl.	*152
do	do	60	do		do		*153
Flows		50			Recent	Pascagoula	153a
		0					154
do	Soft	75	Decreased	Lowered slowly.	Lafayette?	Pascagoula	155
Steam pump	Good	35	Little	Slight	do	Upper Claiborne.	156
do	Hard	30	do	do	do	Under Jackson marl.	157
do	Soft		None	None	Grand Gulf.	Wilcox	*157a
Flows	do		None apparent.		Second river bottoms.	do	158
do	do				Lafayette	Claiborne	158a
do		90		None	Port Hudson.	do	158b
do					do	do	158c
do	Hard	12	None apparent.		Second river bottoms.	do ?	*159
do	Soft	130	do				*160
do	do	200	None				161
do	do	20	None apparent.		Lafayette sand.	Wilcox	*162
do	do	70	do		Post Tertiary.	Pascagoula	*163
do	do	60	do		do	do	*164
do	do	40	do		do	do	165
Flows	Soft	25	do		do		*166
do	Hard	400	Neither			Grand Gulf?	*167

DEEP-WELL RECORDS

Partial list of deep wells

No.	County.	Town.	Owner.	Location. Township.	Range.	Section.	Year completed.	Diameter of well.	Depth of well.	Depth to principal water supply.	Height of water above (+) or below (−) mouth of well.
								In.	Feet.	Feet.	Feet.
*168	Jackson	Ocean Springs	J. J. Kuhn	....	....	....	1891	2½	880	......	+80
169	.....do	.....do	A. A. McGinnes	....	....	....	1885	2½	620	......	+40
170	.....do	.....do	N. B. Smith	....	....	....	1885	2½	514	......	+20
*171	.....do	.....do	Wm. De Pass	....	....	....	1898	2½	520	......	+30
172	.....do	.....do	Chas. Zeigler	....	....	....	1901	2½	560	......	+30
173	.....do	.....do	Mr. Sullivan	....	....	....	1901	2½	540	......	+25
174	.....do	.....do	J. Feitag	....	....	....	1888	2½	525	......	+30
175	.....do	.....do	John Blank	....	....	....	1902	2½	550	......	+50
176	.....do	.....do	Captain Benson	....	....	....	1890	2½	550	......	+50
*177	.....do	.....do	People's water-works.	....	....	....	1901	3	965	......	+75
*178	.....do	.....do	George Rose	....	....	....	1897	4	900	......	+16
*179	.....do	.....do	George Rose, of New York.	....	....	....	1903	8-4	1,200	900	0
*180	.....do	.....do	Electric Ice Co	....	....	....	1903	3	866	......	0
*181	.....do	Scranton	City	....	....	....	1897	6	800	......	+43
*182	.....do	.....do	F. H. Lewis	....	....	....	1891	2½	720	......	+30
*183	Jones	Ellisville	County	7	12	5	1902	6	1,300	350	−20
*184	.....do	Laurel	Kingston Lumber Co.	....	....	....	1902	6	365	325	−40
185	.....do	.....do	Cotton mills	9	11	32	1902	6	210	200	−40
*186	.....do	.....do	Waterworks	9	11	32	1901	8	370	370	−40
187	.....do	.....do	Eastman, Gardner & Co.	9	11	32	1900	6	215	200	−40
187a	Kemper	Forrest	City	....	....	....	......	....	219	217	−90
188	Lafayette	Oxford	.....do	8	3	28	1896	10	185	100	−50
189	.....do	.....do	University	8	3	28	1897	....	185	100	−50
189a	Lamar	Lumberton	Hinton Lumber Co	....	....	....	......	8	1,800	......	......
*190	Lauderdale	Lauderdale	M. & O. R. R	8	17	24	1902	6	133	......	− 6½
190a	.....do	Meridian	City	....	....	....	......	....	900	......	−30
191	.....do	Lauderdale	John Nunnery	8	17	24	1902	2½	108	......	+ 1½
*192	.....do	.....do	M. Smith	8	17	24	1901	2	216	......	− 7
193	.....do	.....do	John Nunnery	8	17	24	1901	2½	108	......	+ 1½
*194	.....do	.....do	M. & O. R. R	8	17	24	1901	6	132	......	− 6½
195	.....do	Meehan Junction.	Meehan-Rounds Lumber Co.	6	14	33	1902	3	324	......	0
*196	.....do	.....do	.....do	6	14	33	1902	3	324	......	+ 0
*197	.....do	Meridian	City	....	....	....	1902	5	305	......	− 5½

*See text, pp. 32–33, for additional data.

IN MISSISSIPPI—*Continued.*

in the State of Mississippi—Continued.

How obtained at surface.	Quality.	Supply per minute.	Increase or decrease of supply.	Effect of pumping on level of water.	Geologic horizon of well mouth.	Geologic horizon of principal water-bearing stratum.	No.
		Gals.					
Flows	Soft	150	None apparent.		Post Tertiary.	Pascagoula	*168
do	do	80	do		do	Clay above Pascagoula.	169
do	do	25	do		do	Post-Tertiary clays.	170
do	do	60	do		do	do	*171
do	do	60	do		do	do	172
do	do	50	do		do	do	173
do	do	60	do		do	do	174
do	do	26	do		do	Post-Tertiary sands.	175
do	do	100	do		do	do	176
do	do	250	Neither		do	Pascagoula	*177
do	do	100	None apparent.		do	do	*178
do	Alkaline		do		do	do	*179
do	Soft	240	do		do		*180
do	do	150	do		do	Pascagoula	*181
do	do	60	do		do	do	*182
	Hard				Lafayette	Grand Gulf?	*183
Pump	Soft	150	None apparent.	None apparent.	do	do	*184
do	do	150	do	do	do	do	185
Compressed air.	do	280	do	None	do	do	*186
do	do	140	do	do	do	do	187
					do	Claiborne	187a
Pump	Soft		None apparent.	Slight	do	Wilcox	188
do	do		do	None observed.	do	do	189
					do	Grand Gulf	189a
Pump	Soft	115	None apparent.	Lowered	do	Wilcox	*190
					do	do	190a
Flows	Soft		None apparent.		do	do	191
Pump	do		do		do	do	*192
Flows	Hard		do		Wilcox	do	193
Pump	do	100	do	Slight	do	do	*194
Flows	Soft	11	Neither		Lafayette	do	195
do	do	11	do		River alluvium.	do	*196
Pumps	Hard				Creek bottom.	do	*197

DEEP-WELL RECORDS

Partial list of deep wells

No.	County.	Town.	Owner.	Location. Township.	Range.	Section.	Year completed.	Diameter of well.	Depth of well.	Depth to principal water supply.	Height of water above (+) or below (−) mouth of well.
								In.	Feet.	Feet.	Feet.
198	Lauderdale	Meridian	City				1902	2½	257		+4
*199	do	do	do				1882	2	905		−20
200	do	do	do				1903	5	305		− 5½
*201	do	do	Ice factory				1890	3	680		−25
*202	do	Siding	W. J. Graham	6	14	22	1895	3	77	40	+22
*203	do	do	Mrs. Martha Maxwell.	6	14	22	1896	3	75		+ 0
204	Lawrence	Silver Creek	A. T. Longino	7	20	10		12	80	70	−70
205	do	do	Dr. B. B. Cowant	7	20	6	1898	10	89	73	−73
*205a	Lee	Baldwyn	Brick Co.						380		− 5
206	do	Guntown	Robt. Gambrell	7	6	12	1870	5	70	70	−40
206a	do	do	City						300		−30
207	do	Nettleton	Jno. McGaughey	11	6	11	1898	4	140	110	+ 0
208	do	Plantersville	R. S. Rodgers	10	6	34	1899	6	160	149	+ 0
209	do	do	Robt. Birmingham	11	6	1	1898	4½	140	140	−60
*210	do	Rusk	L. B. Gandy	10	6	3½	1902	3½	322	300	+ 0
211	do	do	W. S. Brown	11	6	2	1886	36	130	80	+ 4
212	do	Shannon	J. K. Whitesides	11	6	19	1903	4½	300		−15
212a	do	Tupelo	U. S. Bureau of Fisheries.				1903	4½	398	320	+ 0
*212b	do	do	Mo. and Ohio R. R.						436	406	+ 0
212c	do	do	City						300	300	− 8
213	do	Verona	L. T. Taylor	10	6	20	1870	10	285	200	+ 0
214	do	do	do	10	6	19	1889	6	400	285	−60
215	Leflore	Greenwood	A. F. Gardner	19	1	10	1901	4	490	400	+40
215a	do	do	T. B. Minyard					2	266	194	+
216	do	do	T. J. Phillips	19	1	15	1900	4	650	600	+40
*217	do	do	Ice factory				1896	4	650	600	+ 0
218	do	Ittabena	L. J. Young & Co.	19	1	20	1897		597		+35
219	do	do	Mahoney Bros.	19	1	20	1897	3	596½		+ 0
220	do	do	R. W. Baird	19	1	13	1896	3	365	348	+ 0
221	do	do	A. Henderson	19	1		1898	2	450		+ 0
*221a	do	Minter City	C. E. Feigler	22	1	15	1900	2	437	420	+40
222	Lincoln	Brookhaven	W. R. Norton	8	6	25	1901	12	60	60	−54
223	do	do	S. P. Oliver	7	8	7	1898	6	155	115	−40

*See text, pp. 33-34, for additional data.

IN MISSISSIPPI—Continued.

in the State of Mississippi—Continued.

How obtained at surface.	Quality.	Supply per minute.	Increase or decrease of supply.	Effect of pumping on level of water.	Geologic horizon of well mouth.	Geologic horizon of principal water-bearing stratum.	No.
		Gals.					
Flows	Hard		None apparent.		Wilcox	Wilcox	198
Motor	do		do	Easily lowered.	do	do	*199
Pump	do				Second river bottoms.	do	200
Steam pump	do		None apparent.	Easily lowered.	Wilcox	do	*201
Flows	Soft		do		Buhrstone	do	*202
do	do		do		do	do	*203
	do		do	Little	Lafayette	Lafayette	204
Bucket	Hard		do	Slight	do	Grand Gulf	205
					Selma	Eutaw	*205a
Bucket	Soft		None apparent.	Slight	Lafayette clay.	Top of Tuscaloosa	206
	Hard				do	Eutaw	206a
Flows	Hard, good.	5	Neither		Selma	Tuscaloosa	207
do	Soft		None apparent.		do	do	208
Pump	Hard		do	Little	do	do	209
Flows	Soft	15	Neither		River bottom.	do	*210
do	do	3	do		Creek bottom.	do	211
Pump	do		None	None	Selma	do	212
Flows	do		do	do	do	do	212a
do	Small		Decreased		Lafayette	Eutaw	*212b
Pump					do	do	212c
Flows	Soft and pure.	10	None apparent.		Selma	Tuscaloosa	213
Pumps	Soft		do	Slight	do	do	214
Flows	do		do		Port Hudson.	Claiborne	215
do		200			do	do	215a
do	Soft	250	Decreased		do	do	216
do	do	275	None apparent.		do	do	*217
do	Soft and good.		do		Alluvium ?	do	218
do	Soft	60	do		do	Lower Claiborne.	219
do	do	100	Decreased 25 per cent.		Port Hudson.	Wilcox	220
do	do	150	Neither		do	do	221
do	do	50	do		do	Claiborne	*221a
Bucket	do		None apparent.	Easily lowered	Lafayette	Base of Lafayette	222
Air lift	do	275	do	None apparent.	do	Grand Gulf	223

DEEP-WELL RECORDS

Partial list of deep wells

No.	County.	Town.	Owner.	Location. Township.	Range.	Section.	Year completed.	Diameter of well.	Depth of well.	Depth to principal water supply.	Height of water above (+) or below (−) mouth of well.
								In.	*Feet.*	*Feet.*	*Feet.*
224	Lincoln	Brookhaven	S. P. Oliver	7	8	7	1898	8	165		
225	Lowndes	Columbus	City				1898	4	682		+ 6
*225a	do	do	Mobile and Ohio R. R.						420		+ 0
*225b	do	Artesia	do						597	597	− 18
*226	Madison	Canton	City				1896	4	1,020		+ 19
227	do	do	W. H. Powell				1896	6	850	810	+ 16
228	do	Flora	Flora				1896	6	450		− 40
229	Marion	Columbia	City	3	18	5	1903	3	420	400	+ 30
229a	do	do	B. W. Holloway	City.			1905	1½	400	400	+ 20
229b	do	do	G. H. Rankin	3	18	5	1903	2	425	425	+ 25
229c	do	do	Lamar Herrington	3	18	5	1903	1¼	425	425	+ 35
*230	Marshall	Holly Springs	City waterworks	4	2	6	1898	6	400	320	−175
231	do	Hudsonville	E. C. Mahon	2	2	27	1897	8	168		−153
232	Monroe	Amory	T. R. Stevens	12	19	36	1897	2½	154		+ 15
*232a	do	do	City					2½	199	199	+ 0
232b	do	do	Railroad						250	190	+ 0
*233	do	Caledonia	L. D. Booth				1878	6	140		+ 20
233a	do	Crawford	City					4	700		−110
234	do	Gattman	K. C. and B. R. R	13	16	32	1899	6	623	620	+ 27
234a	do	Muldon	Mobile and Ohio R. R.						620		− 83
*235	Montgomery	Winona	Oil and Mining Co	19	5	25	1899	6	412	395	− 60
236	do	do	Electric Light and Ice Co.				1901	10-8-6	400		− 75
237	Neshoba	Dixon	Chas. C. Roberts	9	10	1	1895	40	75		− 70
*238	Newton	Chunkey	Wm. Harris	6	13	34	1898	2¾	160	160	+ 4
239	do	do	Jos. Sharp	5	13	13	1900	2½	150	150	+ 4
240	do	do	D. L. Ragland	5	13	35	1898	3	131	128	+ 0
241	do	Hickory	J. J. Barber	6	12	36	1898	3	150	150	+ 8
*242	do	do	W. H. Galaspy	6	12	36	1898	2½	300	300	+ 2
243	do	do	J. H. Brown	6	6	13	1897	2½	150	150	+ 10
244	Noxubee	Bigbee Valley	A. G. Cunningham	16	19	16			500	391	+ 20
244a	do	Cooksville	W. S. Permenter	13	19	18	1898	6	500	450	− 30
*244b	do	Brookville	Mobile and Ohio R. R.						657	657	− 60
*245	do	Cliftonville	J. B. Cunningham						451	391	− 0
*246	do	Ravine	J. O. Poindexter						725	725	− 26
247	do	do	Sebe Gavin						431	431	+ 16
248	do	Macon	G. N. Ladd				1850	3¼	769		− 0

*** See text, pp. 34-36, for additional data.**

IN MISSISSIPPI—Continued.

in the State of Mississippi—Continued.

How obtained at surface.	Quality.	Supply per minute.	Increase or decrease of supply.	Effect of pumping on level of water.	Geologic horizon of well mouth.	Geologic horizon of principal water-bearing stratum.	No.
		Gals.					
....	Soft....	275	None apparent	None apparent	Lafayette...	Grand Gulf......	224
Flows......	....do...	......	.....do........	....	Selma.......	Tuscaloosa......	225
.....do......	....	130	....	....	.....do......	.....do..........	*225a
....	....	......	....	....	.....do......	Eutaw...........	*225b
Flows......	Soft	170	None apparent	None apparent	Jackson....	Wilcox..........	*226
....do......	....do...	88	Neither.......	....	.....do......	Claiborne?.......	227
Pump......	....do...	......	.....do........	....	.....do......	.....do..........	228
Flows......	....do...	25	None apparent	....	Second river bottoms.	Grand Gulf?.....	229
.....do......	....do...	30	.....do........	....	River bottoms.	Grand Gulf......	229a
.....do......	....do...	60	.....do........	....	Bottom.....	.....do..........	229b
.....do......	Sulphur	25	.....do........	....	.....do......	.....do..........	229c
Steam pump	....do...	100	.....do........	None apparent	Lafayette...	Wilcox..........	*230
Bucket.....	Hard...	......	Little.........	Easily lowered.	.....do......	.....do..........	231
Flows......	Soft....	8	None apparent	....	Selma.......	Tuscaloosa......	232
.....do......	Iron....	25	.....do........	....	Eutaw......	.....do..........	*232a
.....do......	....	......	....	....	Lafayette...	.....do..........	232b
.....do......	Hard...	......	....	....	Tuscaloosa .	.....do..........	*233
....	....	......	....	....	....	.....do..........	233a
Flows......	Hard...	15	None apparent	....	Lafayette...	.....do..........	234
Steam pump	....	......	....	....	.....do......	.....do..........	234a
Air lift......	Soft....	20	.....do........	None..........	Creek bottoms.	Wilcox..........	*235
Pump......	Iron and alkaline, soft.	100	.....do........	....	Lafayette? .	.....do..........	236
....	Soft....	½	.....do........	Easily lowered	.....do......	Lafayette........	237
Flows......	....do...	1	.....do........	....	Alluvial....	Wilcox..........	*238
.....do......	....do...	5	.....do........	....	River bottoms.	.....do..........	239
.....do......	....	5	.....do........	....	.....do......	.....do..........	240
.....do......	Soft....	......	Slight.........	....	.....do......	Claiborne........	241
.....do......	....do...	34	None apparent	....	Second river bottoms.	Wilcox..........	*242
.....do......	....do...	5	.....do........	....	River bottoms.	.....do..........	243
.....do......	....do...	......	.....do........	....	.....do......	.....do..........	244
Pump......	Soft, alkaline.	......	.....do........	Lowered......	....	Tuscaloosa......	244a
....	....	......	....	....	Selma.......	Eutaw...........	*244b
Windmill...	Soft....	......	....	....	.....do......	.....do..........	*245
Hand pump	...do....	......	....	....	.....do......	.....do..........	*246
Flows......	...do....	......	....	....	Aluvium....	.....do..........	247
Windmill...	...do....	......	None apparent	Slight.........	Selma.......	Tuscaloosa......	248

DEEP-WELL RECORDS

Partial list of deep wells

No.	County.	Town.	Owner.	Location. Township.	Range.	Section.	Year completed.	Diameter of well.	Depth of well.	Depth to principal water supply.	Height of water above (+) or below (−) mouth of well.
								In.	*Feet.*	*Feet.*	*Feet.*
*249	Noxubee	Macon	Mobile and Ohio R. R.	....	....	....	1898	3	769	730	+ 8
*250	....do	....do	A. T. Dent	15	17	33	1898	6–4	800	750	− 14
*251	....do	Shuqualak	City	1	17	16	1899	6	910	910	− 10
252	Oktibbeha	Osborn	A. A. Montgomery	....	....	....	......	....	485	485	− 30
*253	....do	Starkville	....do	19	14	3	1900	8	908	......	−130
*254	....do	....do	Agricultural and Mechanical College.	18	14	3	1899	8	900	800	−129
*255	Panola	Batesville	City	....	....	....	1902	4	302	300	+ 20
256	....do	Longtown	Dr. Crenshaw	7	9	6	1902	2	580	520	+ 0
*257	Perry	Barbara	A. J. Thomas	1	10	3	1897	12	72	62	− 62
*258	....do	Brown	A. G. Brown	4	11	1	1892	6	43	38	− 0
259	....do	Hattiesburg	People's ice factory	....	....	....	1900	6	335	......	− 0
260	....do	....do	M. Hemphill	....	....	....	1901	3	350	......	+ 8
261	....do	....do	City waterworks	....	....	....	1900	6–4	335	290	+ 30
262	....do	....do	J. J. Newman Lumber Co.	4	13	11	1899	6	368	368	+ 30
263	....do	....do	G. L. Hawkins	....	....	....	1898	2	380	375	+ 10
264	....do	....do	Gulf and Ship Island R. R.	....	....	....	1902	3	350	300	+ 30
265	....do	....do	Mike Dunn	....	....	....	1902	3	325	......	+ 0
266	....do	Hecla	George Baylis	4	13	10	1897	2	600	......	+ 0
*267	Pontotoc	Ecru	Mobile, Jackson and Kansas City R. R.	....	....	....	1905	8	93	71	− 0
268	....do	McLauren	J. A. Barrow	2	12	4	1897	12	52	48	− 48
269	....do	....do	R. A. Cooper	8	2	29	1902	6	216	216	+
270	....do	....do	V. B. Tucker	8	3	31	1898	6	62	62	+
271	....do	Sherman	D. C. Longston	8	4	36	1899	....	250	250	− 40
272	Quitman	Belen	M. E. Denton	28	2	25	1901	2	840	800	+ 0
273	....do	....do	Turner Bros	28	2	28	1902	3	860	810	+ 0
274	....do	....do	....do	28	1	29	1902	2	724	650	+ 50
275	....do	Lambert	Quitman Developing Co.	27	1	22	1904	2	720	680	+ 30
276	....do	....do	Quitman County Developing Co.	27	1	15	1904	2	690	560	+ 10
277	....do	....do	Bacon Nolan Co	26	1	15	1904	2½	700	650	+ 40
*278	....do	Riverside	L. Marks	28	1	35	1901	2	636	600	+ 40
279	....do	Sumner	Bell & Lawrence	25	1	10	1904	2	650	600	+ 30
280	Scott	Forest	O. B. Triplett	6	8	16	1896	3	220	220	− 9
*281	Smith	Taylorsville	Thomas James	10	14	17	1902	6	1,135	1,100	+ 0

* See text, pp. 36–38, for additional data.

IN MISSISSIPPI—Continued.

in the State of Mississippi—Continued.

How obtained at surface.	Quality.	Supply per minute.	Increase or decrease of supply.	Effect of pumping on level of water.	Geologic horizon of well mouth.	Geologic horizon of principal water-bearing stratum.	No.
		Gals.					
Flows	Soft	5	None apparent	Lowered	Selma	Tuscaloosa	*249
Pump	do		Little	Lowers 16 feet	do	do	*250
do	Alkaline, soft.		None apparent	Little	do	do	*251
					do	do	252
Compressed air.	Soft	145	None apparent	Slight	do	do	*253
do	Soft, alkaline.	145	Neither	do	do	do	*254
Flows	Hard	60	None apparent		Port Hudson.	Wilcox	*255
do	do	50			do	do	256
Bucket	do				Lafayette	Lafayette	*257
	do	100			do	Grand Gulf	*258
Bucket	Soft		None apparent		Second river bottom.	do	259
Flows	do	Few	do		Lafayette	do	260
do	do	250	None	Slight	Second river bottom.	do	261
do	Hard	250	Small decrease		do	do	262
do	Soft	Few	None apparent		Lafayette	do	263
do	do	150	do		Second river bottom.	do	264
do	do		None		do	do	265
do	Hard	100			Lafayette	do	266
Bucket	do				do	do	*267
Cook-pump.	Soft	120	Decreased	Lowered 3 feet in 6 hours.	Ripley	Ripley	268
Flows	do	20			Lafayette	do	269
do	Hard	1½			Ripley	do	270
Pump					Lafayette	do	271
	Soft	20	Decreased		Alluvium	do	272
Flows	do	60	None apparent		Port Hudson.	Wilcox	273
do	do	55	do		do	do	274
do	do	52	Neither		do	do	275
do	do	60	Increased		do	do	276
do	do	100	do		do	do	277
do	do	60	None apparent		do	do	*278
do	do	40	Same		do	do	279
		10			Lafayette	Jackson	280
Flows		6			do	Grand Gulf	*281

DEEP-WELL RECORDS

Partial list of deep wells

No.	County.	Town.	Owner.	Location. Township.	Range.	Section.	Year completed.	Diameter of well.	Depth of well.	Depth to principal water supply.	Height of water above (+) or below (−) mouth of well.
								In.	Feet.	Feet.	Feet.
282	Sunflower	Belmont......	State..............	....	....	....	......	....	1,000	1,000	+
*283	.....do........	Dockery......	Will Dockery.......	22	4	33	1901	2½	929	929	+35
284	.....do........	Doddsville....	R. E. Dodds........	21	3	29	1900	2	820	820	+70
285	.....do........	Indianola.....	City................	....	....	....	1904	4	1,320	......	+49
286	.....do........	.....do........	W. B. Martin.......	19	4	31	1900	3	1,300	1,260	+
*287	.....do........	Moorhead	Chester H. Pond....	18	3	4	1899	2	936	936	+45
288	.....do........	Ruleville......	Chas. Campbell.....	22	3	31	1900	3	864	820	+
289	.....do........	.....do........	Rule Bros..........	22	3	31	1900	2	865	700	+70
290	.....do........	Sunflower....	R. C. Burroughs....	19	3	5	1889	1½	880	880	+
291	Tallahatchie..	Albin..........	Jerry Robinson.....	24	1	29	1900	3	517	......	+
292	.....do........	Charleston....	J. W. Saunders.....	25	2	26	1901	2½	760	545	+18
293	.....do........	.....do........	M. P. Webb.........	24	2	15	1901	2	420	420	+
294	.....do........	.....do........	W. G. Harvey.......	....	....	....	......	....	450	450	+10
295	.....do........	Crevi..........	C. W. Neilson.......	26	2	10	1902	2	400	380	+
296	.....do........	Glendora......	E. D. Graham......	23	12	28	1898	2	465	420	+
297	.....do........	Sharkey Landing.	T. G. James........	24	1	35	1899	3	450	390	+
298	.....do........	Sumner........	I. B. Dudley........	24	2	11	1901	2	552	......	+
299	.....do........	Swanlake......	W. A. Hawkins.....	23	1	10	1901	2	582	......	+
300	.....do........	Webb..........	E. B. Taylor........	24	1	18	1899	2	512	480	+
*301	Tate..........	Staghorn......	S. T. Clayton.......	5	9	21	1901	30	110	107	−
302	Tippah.......	Dumas........	A. C. Anderson.....	4	5	13	1901	40	60	55	−55
*303	Tunica.......	Tunica........	City................	....	....	....	......	....	865	865	+ 0
304	.....do........	Commerce....	R. F. Abbey........	4	11	32	1900	2½	865	......	+
*305	.....do........	Longtown....	....	....	....	....	......	2	521	471	+
*306	Union........	New Albany..	City................	....	....	....	......	....	230	230	+40
*307	Washington..	Leland........	.....do..............	18	7	15	1900	6	512	452	−14
308	Wayne.......	Red Bluff.....	.....do..............	....	....	....	1900	3½	265	......	+ 5
*309	.....do........	Waynesboro..	.....do..............	8	7	12	1900	4	525	......	+10
310	.....do........	.....do........	Ice factory..........	8	7	12	1902	4	520	......	+10
311	.....do........	.....do........	Turpentine distillery	8	7	12	1902	4	525	......	+10
312	Webster......	Walthall......	J. L. Lamb..........	21	10	30	1898	6	......	......	+20
313	Winston......	Louisville.....	W. C. Hight........	15	12	27	1870	36	42	32	−32
314	Yalobusha....	Coffeeville....	J. A. Aston..........	....	....	....	1901	2	250	230	+ 1½
*315	.....do........	.....do........	W. C. Bryant.......	24	6	28	1903	2	238	238	+10
316	.....do........	.....do........	W. H. Bailey.......	24	6	4	1899	2	160	145	+12
317	.....do........	.....do........	J. F. Proovin.......	24	6	....	1901	2	275	250	+ 5
*318	.....do........	Water Valley.	City................	11	4	5	1897	6	60	40	−12
*319	Yazoo........	Yazoo	.....do..............	....	....	....	1905	6	1,577	......	......
320	.....do........	Sartartia.....	M. King.............	10	3	31	1898	3	588	588	+

* See text, pp. 38–39, for additional data.

IN MISSISSIPPI—Continued.

in the State of Mississippi—Continued.

How obtained at surface.	Quality.	Supply per minute.	Increase or decrease of supply.	Effect of pumping on level of water.	Geologic horizon of well mouth.	Geologic horizon of principal water-bearing statum.	No.
		Gals.					
Flows		250			Port Hudson.	Claiborne	282
do		80			do	do	*283
do		80			do	do	284
do		200			do	do	285
do	Alkali	20			do	do	286
do		20			do	do	*287
do		100	Neither		do	Wilcox	288
do		75	do		do	do	289
do		50			do	do	290
do		25			do	do	291
do		32			do	do	292
do		50			do	do	293
do		25			do	do	294
do		40			do	do	295
do		60			do	do	296
do		50			do	do	297
do		12			do	do	298
do		75			do	do	299
do		75			do	do	300
Windlass					Lafayette	do	*301
Bucket					do	Ripley	302
Flows	Soft	200	Neither		Port Hudson.	Wilcox	*303
do	do		do		do	do	304
do	do	3	do		do	do	*305
do		15			do		*306
Pump	Soft		Same	None	Port Hudson.	Claiborne	*307
Flows	do		do		Vicksburg	do	308
do	do	25	do		do	do	*309
do	do	20-40	Variable		do	do	310
do	do	25	None apparent		do	do	311
do		60			Lafayette	Wilcox	312
Bucket					do	do	313
Flows		1½			do	do	314
do		25			do	do	*315
do					do	do	316
do		2			do	do	317
Steam pump					do	do	*318
		14			Alluvium	Claiborne	*319
					Port Hudson.	do	320

SELECTED RECORDS IN DETAIL.

[Numbers in heavy-faced type refer to preceding table.]

10. *Record of city wells at Corinth, Alcorn County.*

[Authority, city waterworks.]

		Feet.
Common soil		15
Blue clay	Selma chalk	20
Sand	Selma chalk	30
Hard rock	Selma chalk	1
Sand, water bearing		35
Hard shale, clay, and fine sand, Eutaw-Tuscaloosa		200
Sandstone, limestone, and shale (Chester and St. Louis)		135
Siliceous rock ("flint rock"), Tullahoma		115

12. *Record of city well at Kosciusko, Attala County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Clay and sand	30	30
Black clay	10	40
Black clay and rock	25	65
Rock, greensand, and shells	25	90
Sand and shells	60	150
Black dirt (lignite)	50	155
Gray sand	40	195
Black clay and gray sand	50	245
Gray sand, black clay, and rock	30	275
Water-bearing sand	5	280

Water is found at 35 feet, 75 feet, 195 feet, and 275 feet. Water rises to 75 feet of surface.

Record of shallow well in sec. 36, T. 20, R. 8 W., Bolivar County.

[Authority, unpublished notes of E. A. Smith, assistant geologist of Mississippi, 1870.]

	Thickness (feet).	Depth (feet).
Surface loam	3	3
Sand, as seen freshly deposited by Mississippi River	3	6
Black buckshot clay	30	36
Red clay, source of water		36

The above is an open dug well. As soon as the red water-bearing clay was reached the water rushed in so rapidly that the digger had hardly time to get out before the well was filled. Water rises to within 15 feet of the surface.

Record of well in sec. 19, T. 19, R. 5 E., Carroll County.

[Authority, unpublished notes of E. A. Smith, assistant geologist of Mississippi, 1870.]

	Thickness (feet).	Depth (feet).
Surface soil.		
Variegated clay	16	16
Indurated ledge of ferruginous sand, with seams of crystalline salenite alternating with layers of greensand	4	20
Greensand	9	29
Indurated ledge of ferruginous sand alternating with layers of greensand, as above	4	33
Hard rock, which effervesced in places	3	36
Siliceous, indurated greensand, with shells	6	42
Light-yellow sand, with ledges of indurated sand, containing concretions of sandstone, also clay nodules embedded in the sand	6	48

Strong mineral water was obtained at 44 feet.

20a. *Record of railroad well at Okolona, Chickasaw County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Soil, gravel, and clay	20	20
Blue limestone (Selma chalk)	300	320
Hard sand rock	3	323
Sand rock	100	423
Greensand, soapstone, and water	50	473
Soapstone	75	548

Water rises within 22 feet of surface.

21a. *Record of well at Hermanville, Claiborne County.*

[Authority, W. G. Herrington, driller.]

	Total depth (feet).
Red clay	
Gray clay	
Sand rock	86
Hard blue clay (hardpan)	
Fine blue sand, which supplies abundant water	

25. *Record of town well at Enterprise, Clarke County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Sand	6	6
Clay and sand	10	16
Quicksand	6	22
Hard blue rock	½	22½
Blue soapstone	97½	120
White sand and blue rock	25	145
Soft soapstone	7	152
White sand and gravel	4	156

35. *Record of Weems well at Shubuta, Clarke County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Sand and clay	25	25
Marl	125	150
Marl, clay, and sand	272	422

Water flows above surface.

52. *Section of town well at West Point, Clay County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Soil and loam	20	20
Limestone (Selma chalk)	180	200
Sand and clay	400	600

Water flowed at first, but does not now.

52a. *Record of town well at Cedar Bluffs, Clay County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Soil and loam	10	10
Limestone (Selma chalk)	450	460
Hard rock	2	462
Sand and water	188	650

Water rises within 100 feet of surface.

Record of well 3 miles south of Grenada, Grenada County.

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Clay	10	10
Sand	30	40
Soapstone	30	70
Sand	10	80
Soapstone (clay)	10	90
Mud	20	110
Soapstone (clay)	10	120
Very coarse sand	95	215
Hard rock	0.25	215.25
Sand	10	225.25
Soapstone (clay)	335	560.25
Two thin rocks	0.75	561
Soapstone (clay)	40	601
Water-bearing sand	63	664
Soapstone	20	684
Water-bearing sand	37	721

Well flows one-half gallon per minute.

56a. *Record of city well at Grenada, Grenada County.*

	Thickness (feet).	Depth (feet).
Surface loam	60	60
Sand	30	90
Soapstone (clay)	30	120
Sand and soft clay	40	160
Soapstone (clay) with sand	90	250
Blue sand	30	280
Soft stone (clay?)	30	310
Soft blue sandy rock, very fine	140	450
Soft clay	10	460
Sand and water	30	490
Soft blue sandy rock	110	600
Rock	20	620

At a depth of 250 feet water rose within 6 feet of surface; at 490 feet the well overflowed.

Record of well 1 mile north of Bay St. Louis, Hancock County.

[Begun October 29, 1904; completed November 20, 1904. Authority, John L. Ford, driller.]

	Thickness (feet).	Depth (feet).
Blue sandy clay	10	10
White sand	50	60
Yellow sand	35	95
White sand and gravel	50	145
Green clay	15	160
Gray sand	60	220
Green clay	130	350
Gray sand	20	370
Green clay	280	650
Water sand, flows 50 gallons per minute	40	690
Blue clay	128	818
Water sand, flows 225 gallons per minute	79	897

Diameter of well, 3 inches. (From Bull. U. S. Geol. Survey No. 264.)

Generalized section of wells between Biloxi and Pass Christian, Harrison County.

[Authority, A. Dixon.]

	Feet.
Sand	80
Clay	125
Sand and clay	425
Light-gray fine sand	500
Clay	600
Water-bearing sand	685

Record of well at Quarantine Station, Ship Island.

[Authority, Dr. P. C. Kallock in Underground Waters of Louisiana (Harris).]

	Thickness (feet).	Depth (feet).
White sand	45	45
Soft clay and mud	155	200
Hard blue clay	100	300
White sand	5	305
Blue clay	260	565
Sandstone	½	565½
Blue clay	156	721½
Water-bearing sand	9	730½

112. *Record of well at Howison, Harrison County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Red clay	100	100
White sand	100	200
Blue clay	1,200	1,400
Water-bearing sand	80	1,480

Water rises within 35 feet of surface.

Log of deep well at State Penitentiary, Jackson, Hinds County.

[Authority, E. W. Hilgard.]

	Thickness (feet).	Depth (feet).
Surface materials and clay marl	20	20
Blue sandy shell marl	11	31
Dry sand, with streaks of whitish or gray clay containing impressions of leaves	80	111
Wet quicksand, caving very badly	70	181
(Here water rose to within 70 feet of surface.)		
Black clays, mostly laminated, interstratified with layers of sand. Fragments of impressions of leaves, and, at 400 feet, a catkin of a willow were bored up	268	449
Greensand, with shells and streaks of gray and red clay	30	479
Water-bearing sand, caving badly	20	499
(Here water rose to within 50 feet of surface.)		
Greensand with shells, same as above	?	
Ledge of gray fossiliferous limestone	1	500
Blue clay, with calcareous nodules and some layers of greensand marl	12	512
Shell marl, with layers of black clay	10	522
Quicksand, with a great deal of mica	5	527
White indurated clay, with iron pyrites, not yet passed through	?	

Record of Alabama and Vicksburg Railroad well at Smiths, Hinds County.

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Soil and clay	44	44
Limestone and sandstone	104	148
Thin strata of hard rock	4	152
Rock and sand	394	546

Water rises within 23 feet of surface; capacity, 113 gallons per minute; mouth of well about 130 feet above sea level.

Generalized section of wells on Deer and Silver creeks, Issaquena County.

[Authority, unpublished notes of E. A. Smith, assistant geologist of Mississippi, 1870-71.]

	Thickness (feet).	Maximum depth (feet).
Top clay	4–10	10
Sand	20–30	40
Blue mud (clay)	10–20	60
Light, fine sand	2–4	64

Pebble bed, containing water.

The above section was given by Mr. I. W. Blessing, who had driven about 70 wells along the above-mentioned creeks. The sand above the pebbles is in very fine, smooth, rounded grains, and comes up with the water when the well is pumped. The pebbles in the bed from which the water comes are often cemented together, forming a hard conglomerate.

167. *Record of well near Moss Point, Jackson County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Sand	100	100
Clay and mud	150	250
Hard clay	150	400
Water-bearing sand	20	420
Hard clay	200	620
Water-bearing sand	40	660
Sand and clay	110	770
Water-bearing sand	44	814
Hard rock, sand, mud, and wood	736	1,550

Flowing water at 650 and at 800 feet.

181. *Record of city well at Scranton, Jackson County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Sand and gravel	350	350
Blue clay	400	750
Clam shells	5	755
Blue clay	25	780
Water-bearing sand	20	800

Well flows 150 gallons per minute.

Record of well at Ocean Springs, Jackson County.

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Surface soil, sand, and gravel	150	150
Clay	250	400
Sand	20	420
Clay	40	460
Sand and gravel	60	520
Clay	400	920
Water-bearing sand	30	950

Water flows 250 gallons per minute.

Record of well 1½ miles northwest of Moss Point, Jackson County.

[Begun October 3, 1904; completed October 12, 1904. Authority, John L. Ford, driller.]

	Thickness (feet).	Depth (feet).
Hard, yellow clay (sandy)	20	20
Yellow sand	15	35
Clay (sandy, variegated)	15	50
Sand (fine, white)	50	100
Sand (coarse, white)	40	140
Clay (sandy)	70	210
Sand (fine, white)	10	220
Clay	150	370
Sand (fine, white)	20	390
Clay	320	710
Sand (fine gray)	80	790
Clay		790

Main water supply 770 to 790 feet. Yield, 135 gallons per minute. (From Bull. U. S. Geol. Survey No. 264.)

Record of city well at Ellisville, Jones County.

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Sand and gravel	80	80
Green clay	280	360
Sand	10	370
Green clay	230	600
Sand rock	12	612
Greenish marl	288	900
Shell rock	5	905
Green marl	195	1,100
Shells	5	1,105
Green marl	295	1,400

Record of city well at Oxford, Lafayette County.

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Clay and sand	90	90
Dry sand	15	105
Clay	67	172
Soapstone (clay)	78	250
Hard sandstone	50	300

Water rises to 70 feet of surface.

Record of well at Lumberton, Lamar County.

[Authority, W. N. Logan and W. R. Perkins.]

	Depth (feet).
Coarse sand and some gravel	40
Fine sand	85-90
Fine sand and white clay	103
Hard white clay	110
Soft but fine sand	180
Hard white clay	200
Hard and soft spots, water white	210
Hard white clay, pipe goes 28 inches per hour	277
White water	314
Blue mud	512-528
Blue mud, still in water	560
Hard clay, white water	620
Very soft rock	670
Very soft white clay	682
Hard clay	720
Blue clay	760
Hard rock	770
Softer rock	784
Bluish rock	830
Hard rock	850
Sand	860

The well was drilled to a depth of 1,800 feet.

Record of cotton-mill well No. 1, Meridian, Lauderdale County.

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Clay	14	14
Sand	16	30
Clay	6	36
Shale	14	50
Sand	1	51
Lignite	2	53
Sand	3	56
Shale	2	58
Pipe clay	19	77
Lignite	6	83
Pipe clay	7	90
Sand	2	92
Clay	3	95
Sand	4	99
Clay	22	121
Sand	5	126
Clay	5	131
Sand	5	136
Blue clay	4	140
Sand	1	141
Blue clay	18	159
Sand	9	168
Lignite	5	173
Sand	2	175
Lignite	4	179
Sandstone	1	180
Clay	7	187
Sand	27	214
Lignite and clay	8	222
Clay	2	224
Sand	2	226
Lignite	2	228
Sand	27	255
Clay	12	267
Lignite	4	271
Clay	27	298
Sand	4	302
Clay	4	306
Sand	6	312
Clay	5	317
Pyrites rock	1	318
Sand	3	321
Clay	7	330
Lignite	2	332
Clay	15	347
Sand	43	390

Water rises within 40 feet of surface.

Record of well in sec. 11, T. 9, R. 8 E., Leake County.

[Authority, unpublished notes of E. A. Smith, assistant geologist of Mississippi, 1871.]

	Thickness (feet).	Depth (feet).
Red clay, with a little sand	6	6
Variegated clays, containing shells	10	16
Light-colored, fossiliferous rock which effervesces with hydrochloric acid	1	17
Variegated clays, as above	9	26
Yellow sand to water	26	52

Record of well at Mooresville, Lee County.

	Thickness (feet).	Depth (feet).
Selma chalk	155	155
Eutaw sands, source of water	20	175

205a. *Record of Brick and Tile Company's well at Baldwyn, Lee County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Soil, clay, and sand	40	40
Limestone (Selma chalk)	74	114
Clay and sand (Eutaw)	220	334
Water-bearing sand	46	380

Water rises within 5 feet of surface.

212b. *Record of Mobile and Ohio Railroad well, Tupelo, Lee County.*

[Authority, M. & O. R. R. Co.]

	Thickness (feet.)	Depth (feet).
Sand and gravel	15	15
Limestone } Selma chalk	200	215
Hard rock } Selma chalk	1	216
Soft rock } Selma chalk	150	366
Greensand, water-bearing	40	406
Clay	30	436

Water flows above surface.

Record of T. B. Minyard's well, at Greenwood, Leflore County.

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Soil and clay	15	15
Mud and silt	140	155
Soapstone (clay)	200	355
Greensand, with the strata of hard rock	20	375

221a. *Record of well at Minter City, Leflore County.*

[Authority, C. E. Feigler, driller.]

	Thickness (feet).	Depth (feet).
Surface soil	10	10
Sand	100	110
Gravel	10	120
Sand	80	200
Soapstone and pipe clay interbedded with sand to bottom of well	237	437

225a. *Record of railroad well at Columbus, Lowndes County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Clay, sand, and gravel	25	25
Sandstone	300	325
Greensand and clay	95	420

225b. *Record of railroad well at Artesia, Lowndes County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Clay	10	10
Limestone (Selma chalk)	350	360
Hard sandstone	2	362
Soft sandstone and soapstone	175	537
Clay and sand	60	597

Water rises to within 18 feet of surface.

Record of well at Canton, Madison County.

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Surface sand and clay	150	150
Clay	175	325
Water-bearing sand	30	355
Clay	60	415
Water-bearing sand	30	445

Record of well in sec. 2, T. 7, R. 2 E., Madison County.

[Authority, E. W. Hilgard.]

	Thickness (feet).	Depth (feet).
Surface materials and bluish and yellowish clay marls	40	40
Blue clay marl, poor in shells	40	80
Blue sandy shell marl, with well-preserved shells	10	90
Dark-colored, mostly bluish, laminated clays interstratified with layers of sand	185	275
Hard gray sandstone	$\frac{1}{12}$	
Yellow water-bearing sand	15	290
(Here water rose to within 75 feet of surface.)		
Dark-colored sandy clay, with crystals of gypsum	85	375
Hard gray sandstone	$\frac{1}{12}$	
Lignite, interstratified with layers of clay; above it a stream of water rising to within 45 feet of surface (as far as penetrated)	40	375 415

230. *Record of town well at Holly Springs, Marshall County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Reddish clay (Columbia)	20	20
Red sand (Lafayette)	87	107
Sand rock	1	108
Clay	52	160
Hard sandstone	½	160½
Clay and sandstone	139½	300
Fine sand, water bearing	40	340
Pipe clay	13	353
Coarse sand	4	357
Sticky clay	43	400

General section of wells in river bottom near Aberdeen, Monroe County.

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Surface soil and loam	15	15
Sandstone	200	215
Sand and first water	35	250
Clay and lignite	100	350
Sand and water	30	380

232a. *Record of well at Amory, Monroe County.*

[Authority, A. F. Crider; section obtained from old well driller.]

	Thickness (feet).	Depth (feet).
Lafayette sand	12	12
Lafayette gravel	6	18
Gray sand, water bearing	1	19
"Soapstone," or joint clay, with thin layers of shelly sandstone. The clay caved when drilling well and had to be cased	115	134
More compact clay, which required no casing in drilling	65	199
Sand, source of water.		

Water was obtained in sand below the compact clay. It flows at rate of 20 to 25 gallons per minute from a 2½-inch pipe. The water is highly impregnated with iron oxide. The pipe and gutter which carry the water from the well are covered with a thick coating of iron oxide. The same driller reports that a second stream of water is present here at a depth of from 240 to 250 feet.

Well at Gattman, Monroe County.

[Authority, W. F. Riley, owner.]

	Thickness (feet).	Depth (feet).
Sandy yellow clay	18	18
Fine sand (quicksand)	65	83
Gravel and sand	4	87
Yellow sand Gray sand Blue clay Deep-red clay Lignitic clay Sand	113	300
Hard grayish sand rock	2	302
Fine sand or opening from which water rose to surface, furnishing about 2 gallons per minute	6	308
Small, round gravel, about the size of large shot	3	311
Hard gray sandstone (hard as millstone), becoming softer and darker in color below. Water rose to surface from this soft sandstone	312	623

Water flows above surface at the rate of 15 gallons per minute, is full of gas bubbles, and has a taste of borax and soda.

235. *Record of well at Winona, Montgomery County.*

[Authority, Robert A. Allison.]

	Thickness (feet).	Depth (feet).
Soil and clay	25	25
Orange-colored sand	10	35
Blue marl	40	75
Lignite	5	80
Quicksand	15	95
Black clay	50	145
Coarse sand, containing fair supply of water	10	155
Lignite	10	165
Blue marl	35	200
Fine sand	15	215
Clay	10	225
Quicksand	60	285
Clay	40	325
Fine sand, coarse on top	25	350
Brown clay	35	385
Coarse sand, gravels on top	27	412

Water is obtained in the lowest layer of coarse sand and gravel at a depth of 395 feet. About 25 or 30 wagonloads of sand were pumped from the well during the first three or four days. After that the sand ceased to rise, and the well now furnishes an abundant supply of water, which is not perceptibly lowered with an air-lift pump. Water is clear and free from minerals, and is reported to have a temperature of 65° F.

244b. *Record of railroad well at Brookville, Noxubee County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Clay	8	8
Limestone (Selma chalk)	450	458
Hard sand	4	462
Soft sand	150	612
Greensand and water	45	657

The water rises within 60 feet of surface.

245. *Record of well at Cliftonville, Noxubee County.*

[Authority, J. B. Cunningham, driller.]

	Thickness (feet).	Depth (feet).
Selma chalk	300	300
Greensand	20	320
White sand	20	340
Greensand	10	350
White sand	40	390
Ferruginous sandstone	1	391
Dark greensand, source of water	60	451

246. *Record of well at Ravine, Noxubee County.*

[Authority, J. B. Cunningham, driller.]

	Thickness (feet).	Depth (feet).
Selma chalk	250	250
Greenish-colored sand (Eutaw)	475	725

249. *Record of Mobile and Ohio Railroad well, Macon, Noxubee County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Clay	8	8
Limestone (Selma chalk)	600	608
Hard sandstone	3	611
Soft sandstone	65	676
Greensand and water	40	716
Soapstone	53	769

251. *Record of Shuqualak well, Noxubee County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Clay	10	10
Limestone (Selma chalk)	750	760
Sandstone	100	860
Greensand and water	50	910

Water rises within 10 feet of surface.

254. *Record of well at Starkville, Oktibbeha County.*

[Authority, Bulletin of the Mississippi Agricultural and Mechanical College, vol. 1, No. 2, page 10.]

	Thicknes (feet).	Depth (feet).
Surface soil	14	14
Selma chalk	749	763
Shell rock	4	767
Clay (sandy)	24½	791½
Shell rock	7	879½
Sand (micaceous)	56	854½
Clay	10	864½
Sand	35½	900

Water rises within 150 feet of the surface.

255. *Record of town well at Batesville, Panola County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Surface	10	10
White sand	25	35
Blue clay	10	45
Clay and sand	215	260
Rock	2	262
Water-bearing sand	40	302

Water rises 20 feet above the surface; flows 50 gallons per minute.

257. *Record of well at Barbara, Perry County.*

[Authority, A. J. Thomas, owner.]

	Thickness (feet).	Depth (feet).
Red surface clay	40	40
Coarse sand and sandstone	2	42
Blue pipe clay	7	49
Yellow sand	13	62
White sand and sandstone	10	72

General section of wells at Hattiesburg, Perry County.

[Authority, W. N. Logan and W. R. Perkins.]

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

There are about 25 wells in the town flowing from 5 to 50 gallons per minute.

258. *Record of well at Brown, Perry County.*

[Authority, A. G. Brown, owner.]

	Thickness (feet).	Depth (feet).
Red clay	20	20
Variegated sand, of white, red, and yellow color, with occasional thin layers of "rock"	23	43

Water obtained at 38 feet.

267. *Record of well at Ecru, Pontotoc County.*

[Authority, Albert Goldsbury, driller.]

	Thickness (feet).	Depth (feet).
Red clay and loam	23	23
Blue clay	27	50
Hard limestone	4	54
Reddish muddy sand	5	59
Shell marl	1	60
Sand	3	63
Reddish sand, water-bearing	10	73
Gray clay to bottom of well	20	93

Diameter of well, 6 inches. Water barely flows over surface, and is raised to tank by steam pump. It is clear, and is used in locomotive boilers.

278. *Record of L. Marks's well at Riverside, Quitman County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Blue mud	40	40
Mud and water-bearing sand	45	85
Water-bearing sand and gravel	50	135
Sand and gravel	40	175
Soapstone (clay)	220	395
Rock	½	395½
Soapstone (clay)	50	445½
Rock	½	446
Greensand	10	456
Lignite	1	457
Soapstone (clay) and water-bearing sand	179	636

Record of town well at Forest, Scott County.

[Authority W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Mud and gumbo	60	60
Black mud	15	75
Grayish sandy clay	25	100
Gray sand and iron pebbles	50	150
Lime rock	40	190
Sandy rock	5	195
Dark-gray hard rock	22	217
Water-bearing sand	2	219

Water rises within 90 feet of surface.

Record of well in sec. 8, T. 10, R. 7 W., Sharkey County.

[Authority, unpublished notes of E. A Smith, assistant geologist of Mississippi, 1870.]

	Thickness (feet).	Depth (feet).
Sandy loam Dark, sticky clay	20	20
Buckshot clay	10	30
Fine, sticky, sandy clay, containing water		30

281. *Record of well at Taylorsville, Smith County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Grayish-brown clay	100	100
Blue clay	200	300
Sand, gravel, and water	15	315
Brownish clay	85	400
Hard rock	23	423
Sand	3	426
Brownish clay	704	1,130
Brown sand, very fine	5	1,135

Water flows 10 gallons per minute.

283. *Record of well at Dockery, Sunflower County.*

[Authority, Will Dockery, owner.]

	Thickness (feet).	Depth (feet).
White sand	60	60
Gravel and sand	115	175
Quicksand with strata of clay about 50 feet apart; flowing water	600	775
Sand rock in layers 18 inches to 2 feet thick interbedded with sand	25	800
Greensand interbedded with rock	129	929

294. *Record of well at Charleston, Tallahatchie County.*

[Authority, W. G. Harvey, owner.]

	Thickness (feet).	Depth (feet).
Sands, silts, and clays	200	200
Sandstone rock	10	210
Lignite and lignitic clays	140	350
Quicksand	100	450

Water rises 8 to 10 feet above the surface. Capacity, 25 gallons per minute.

Record of town well at Charleston, Tallahatchie County.

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Clay and blue mud	50	50
Sand	40	90
Soapstone (clay)	100	190
Hard white rock	2	192
Water-bearing sand	100	292
Soapstone (clay)	30	322
Water-bearing sand	40	362

Well flows 32 gallons per minute.

301. *Record of well at Staghorn, Tate County.*

[Authority, S. T. Clayton, owner.]

	Thickness (feet).	Depth (feet).
Surface clay	20	20
Gravel and sand	15	35
Red sand which changes to white sand Pipe clay and sand, furnishing water	75	110

Water rises but a few feet in the well.

Record of well at Senatobia, Tate County.

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Clay	24	24
Coarse gravel	15	39
Quicksand	21	60
Clay	4	64
Sand	10	74
White clay	2	76
Sand	14	90
Pipe clay	2	92
Water-bearing sand	28	120

Water stands within 40 feet of the surface.

303. *Record of well at Tunica, Tunica County.*

[Authority, W. J. Brigham.]

	Thickness (feet).	Depth (feet).
Alluvial sand and clay	15	15
Fine silt, sand, and clay	75	90
Fine white sand	250	340
Sand and gravel with layers of lignite Sand Hard, impervious clay White sand containing water	525	865

Water is soft and flows above surface.

305. *Record of well 5 miles west of Longtown, Tunica County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Soil and clay	30	30
Sand	110	140
Pipe clay	260	400
Rock	1	401
Sand	10	411
Soapstone (clay)	60	471
Sand and water	50	521

Water flows 15 gallons per minute.

306. *Record of well at New Albany, Union County.*

[Authority, Ed. Baker, driller.]

	Thickness (feet).	Depth (feet).
Surface clay	20	20
Calcareous sandstone	4	24
Clayey sand, water bearing	15	39
Blue sandy marl containing shells, with strata of limestone 3 to 4 feet thick at occasional intervals	165	204
White sand, source of water	20	224

307. *Record of city well at Leland, Washington County.*

[Authority, E. F. Turner, chairman of water committee.]

	Thickness (feet).	Depth (feet).
Buckshot clay	2	2
Fine sand	138	140
Gravel	14	154
Hard blue clay, containing six strata of sandstone rock, ranging in thickness from 6 inches to 2 feet	298	452
Coarse gray sand	60	512

Analysis of the above water is reported to have given 154.1 parts per million of solid matter, 119.8 of which were soda.

309. *Record of town well at Waynesboro, Wayne County.*

[Authority, W. N. Logan and W. R. Perkins.]

	Thickness (feet).	Depth (feet).
Surface clay	30	30
Sand and water	150	180
Marl and clay with flint "bowlders"	300	480
Water-bearing sand	20	500
Clay	25	525

Water flowed above surface from 180 feet.

318. *Record of well at Water Valley, Yalobusha County.*

[Authority, R. F. Kimmons, mayor.]

	Thickness (feet).	Depth (feet).
Common surface clay	12	12
Water-bearing sand	15	27
Stiff pipe clay	18	45
Water-bearing sand	15	60

The city of Water Valley has nine wells similar to the above, which furnish 500,000 gallons of water per day. Water stands within 12 feet of the surface. Six of the wells have furnished the above amount of water without any appreciable variation. All the wells are dug within a radius of 100 feet.

Record of well in sec. 23, T. 14, R. 4 W., Yazoo County.

[Authority, unpublished notes of E. A. Smith, assistant geologist of Mississippi, 1870.]

	Thickness (feet).	Depth (feet).
Surface soil	2½	2½
Red clay	6	8½
Buckshot clay Blue mud	21½	30

Water is warm and has slight mineral taste.

SANITARY ASPECT OF WELLS.

There is a widespread popular belief that clear, cold water coming from any kind of well is pure and wholesome, and until recent years the open well has been considered one of the most valuable adjuncts of the home or farm. In reality, however, wells of the open type are especially liable to pollution and may be the source of disease. On many premises the open well is in the lowest ground, and above it on the slopes are barns, outhouses, and dwellings. Such a case is illustrated in Pl. VI, *B*. The lowest ground is chosen for the well because water is found there at less depth than elsewhere. The fact that the impurities from the sources mentioned are carried both by the surface water after each rain and by underground seepage downward in the direction of the well is commonly lost sight of. Water laden with impurities may either enter the top of the well, where this is unprotected by embankments, or it may enter through the wood, brick, or stone curbing. The pollution of the well by seepage is especially likely to occur where the soil is porous and the well shallow, and, in limestone regions, where open underground channels exist.

It is not infrequently the case that open wells are left uncovered, so that impurities carried by the winds are free to settle through the open mouth. Where covered, the top of the well is often but little above the ground level, and the covering is made of unjointed planks loosely thrown down and having large openings between them. Wooden curbs, which in dry weather shrink and later admit much surface water to the well, are in common use. Chickens and pigs tramping around the barnyard and open privies and workmen from the barnyard or manured fields often carry filth on their feet. The first shower of rain or the drippings from the well bucket may carry these poisonous germs into the well. There are numerous instances in Mississippi where little cesspools have been dug in the ground near the wells and are kept filled with water for chickens, ducks, turkeys, and pigs. This water becomes highly polluted and more or less of it sinks into the earth and finds its way directly into the well.

A. OUTFIT FOR DRIVING TUBULAR WELLS.

Such wells are ordinarily safe, as the shallow polluted waters are shut off.

B. A COMMON BUT HIGHLY DANGEROUS WELL LOCATION NEAR BARNS AND OUTHOUSES.

Drainage is toward well. Photograph by M. L. Fuller.

When in health the human body is resistant to disease, and polluted waters may be used for years without causing sickness; if, however, the human system for any reason becomes weakened, disease germs, if present, may rapidly develop. Many outbreaks of typhoid fever, both in this country and in Europe, have been traced to polluted wells or to milk distributed in cans washed in the water from them.

The well, if used for drinking water, should occupy a high point on the premises and should be so situated that polluted waters from any source can not run near it. If the well is an open one the upper part should be dome-like in shape and sealed with cement, with a tightly fitting top, so that no impurities of any kind can get in.

Many who are accustomed to the open well have a prejudice against drinking water from an iron pump. The driven, bored, and drilled wells have, however, many advantages over the large dug wells, some of which are as follows:

1. There is less possibility of getting impurities into small-bore wells put down with machinery.

2. There is always a possibility that rats, frogs, and other objectionable animals or matter, such as filth from the barnyard, will get into an open well if the cover is left off in some unguarded moment. The well of small diameter which has a pump in it is sealed from all small animals, bugs, and even dust. A few strokes of the pump will remove the water which has been standing in the pipe and bring up water which is fresh and uncontaminated.

3. The well of small diameter, when properly made, shuts off all surface waters and objectionable seepage waters. If a good supply is found, all the objectionable waters above and below should be cased off, so that only the desirable supply is admitted into the pipe.

The so-called "streams" of water in Mississippi and the entire Gulf embayment area occur in horizontal sheets of sand. These water-bearing sands are usually overlain by layers of clay which prevent the waters immediately above the clay from entering the sands below. Where this tough clay layer is penetrated by the drill the water from above will flow down to the bottom of the well unless it is shut off. But when iron casing is put in, packing can be placed between the outside of the pipe and the clay layer, thus sealing up the hole made by the drill and shutting off undesirable waters.

4. It is not possible to dig wells by hand to a very great depth, and in some instances, as in some localities in the Northeast Prairie and in the Yazoo Delta, it is impossible to dig them to the desired source of water without putting in some kind of curbing. In the various artesian basins over the State artesian wells are obtained only by drilling or boring.

If water runs through a sufficient amount of pure sand it will give up a considerable part of its impurities. A large part of the surface of Mississippi is made up of such sand, which serves as a natural filter for the waters. In the more hilly sections of the State this sand contains such a small amount of decayed organic matter that waters even from the shallow wells in the Lafayette sands rarely show a trace of organic matter. The shallow wells very seldom have any strong undesirable minerals in their waters, so that such wells in the rural hilly districts of the State furnish, as a rule, excellent drinking water.

Conditions are different in the Yazoo Delta and in the Northeast and Central prairies. The delta is a low, recently formed land, made up of sands and clays containing a large amount of decayed vegetation. The soil is very fertile and produces a vigorous growth of succulent plants, many of which grow up and decay in a year. Large quantities of free ammonia, albuminoids, nitrates, and nitrites are thus set free, part of which are carried down into the soil and thus come in contact with the waters, which rise within a few feet of the surface.

In the Northeast and Central prairies much of the surface sand has been removed, leaving a limestone-clay soil, which as a rule is barren of water.

ANALYSES.

Analyses of Mississippi waters, in parts per million.

DEEP WELLS.

Locality.	Name of well.	Sodium (Na).	Potassium (K).	Calcium (Ca).	Magnesium (Mg).	Sulphate radical (SO_4).	Chlorine (Cl).	Carbonate radical (CO_3).	Phosphate radical (PO_4).	Silica (SiO_2)	Iron and alumina (Fe_2O_3+ Al_2O_3).	Iron (Fe).	Organic matter.	Authority.[a]
Aberdeen	Aberdeen	12.1	5.96	6.28	2.38	1.80	6.11	29.3		11.9	18			A, p. 31.
Ackerman	Kramer	31.7	4.94	11.3	8.15	2.32	6.08	75.7	1.24	28.9	13.5			A, p. 110.
Agricultural college	College	222	4.73	5.22	.473	3.21	125	388		3.39		0.694		A, p. 42.
Do	Muldrow's	291	13.6	8.28	4.49	1.17	175	505		11.9		1.38		A, p. 43.
Amory	Amory	7.12	4.25	3.71	1.86	3.57	4.21	16.9		8.38	11.1			A, p. 30.
Artesia	Railroad	232	7.66	8.44	1.96	.904	6.85	319		16.4	1.99			A, p. 37.
Batesville	Batesville	5.98	3.45	2.71	2.48	4.72	5.46	13.1		29.9	17.2			A, p. 99.
Biloxi	Well No. 1	56.1	.942	.535	.140	7.18	5.88	65.5	[b] 1.46	41	.748			A, p. 73.
Do	Waterworks	116	1.23	1.32	.259	4	2.82		[b] 1.34	24	.798			A, p. 74.
Bolton		121	7.2	19	5	55	35	140		27	12		39	B.
Brookhaven	Brookhaven	14.4	5.49	3.78	.939	2.28		6.25		11.7	.698			A, p. 67.
Canton	Waterworks	37.4	3.31	6.21	1.56	11.3	6.32	52		56.1	1.14			A, p. 111.
Clarksdale	Well No. 1	161	3.05	.926	.325	1.13	44.6	176	[b] 2.81	38.7	1.30			A, p. 82.
Do	Well No. 2	112	4.12	41.5	18.2	1.14	19.6	237	[b] .121	16.7	1.65			A, p. 83.
Do	Well No. 3	8.98	2.73	45.4	29.5	2.18	6.83	148	[b] 1.27	30.6	5.93			A, p. 84.
Cleveland	Cleveland	254	3.73	1.07	.481	1.17		331	[b] 6.92	18.1	6.99			Do.
Cliftonville	Cliftonville	64.6	1.60	1.43	.270	1.47	68.9	81.4	[b] 1.92	.204	1.75			A, p. 47.
Columbia	Columbia	12.7	4.64	4.17	.952	18	5.99		[b] .534	38.3	1.20			A, p. 64.
Columbus	Main street	7.85	6.63	10.4	3.77	.101	3.79	37.5		9.40	14.2			A, p. 35.
Do	Kaye	11.1	9.27	7.77	2.62	.534	8.84	29.6		10.3	3.34			Do.
Do	Ice factory	11.8	7.21	9.13	3.10	.431	4.63	38.1		9.88	9.08			A, p. 36.
Crawford	Crawford	249	11.3	10.2	3.87	13	135	227		18.9	2.59			A, p. 38.
Dockery		185	13	2.9	1.40	1.2	14.5	237	6.7	25	.9			C.
Doddsville	Doddsville	192	6.48	2.53	.497	3.57	3.79	254	([b])	20.6	2.49			A, p. 87.
Durant		46		65	6.6	54	39	106	([b])	20				D.
Do	Durant, I. C. R. R. Co.	73.6	12.2	4.92	7.93	25.6	11.8	107	.339	25.6	.597			A, p. 103.

Enterprise	Town	107	12.6	2.64	.721	4.79	3.79	148	b 1.23	14.3	.748	....	....	A, p. 56.
Glendora	Sturdivant	122	1.96	1.11	.551	2.05	18.2	147	b 3.62	30.1	.847	....	....	A, p. 91.
Greenville	Greenville	123	2.68	.606	.595	1.85	32.4	135	b 2.14	24.9	.397	....	....	A, p. 93.
Greenwood	....	55	....	2.2	.63	5	3.5	70	(b)	34	2.9	....	....	D.
Do	McNeal	30.7	9.32	16.2	4.51	4.23	7.48	73.5	....	27.8	1.93	....	....	A, p. 93.
Do	City	36.8	6.40	10.6	3.01	2.18	4.19	71.4	....	31.3	.798	....	....	A, p. 94.
Grenada (depth 620 feet.).	....	166	4.3	3.7	1.5	1.2	90	150	3	11	1	....	....	
Gulfport	Railroad	49.6	3.93	1.28	.217	9.97	5.88	58.9	b 1.34	20.8	.399	....	....	A, p. 72.
Do	Pier	69.4	1.53	.963	.194	7.18	5.88	84	b 1.28	24.3	.599	....	....	Do.
Hattiesburg	Waterworks	8.95	5.24	6.42	2.39	8.73	6.32	20.5	....	34.9	1.35	....	....	A, p. 63.
Hickory	Hickory	54.4	4.39	13.9	4.11	.473	3.62	102	b .298	32.5	.839	....	....	A, p. 53.
Holly Springs	Holly Springs	10.8	2.34	6.42	2.04	.532	16	16.7	....	11.7	.199	....	....	A, p. 105.
Indianola	Well No. 1	272	2.72	.855	.308	.945	9.10	350	b 7.30	24.6	.998	....	....	A, p. 86.
Ittabena	Ittabena	92.5	4.85	4.06	1.68	3.16	4.98	124	....	28.4	2.59	....	....	A, p. 96.
Jackson	Jackson's	23.2	6.42	99.8	20.6	32.4	13.6	204	....	44.6	.787	138	....	A, p. 112.
Leflore	Pollard	40.4	7.51	11.8	5.76	.737	6.74	84.3	....	32.7	2.10	....	....	A, p. 109.
Leland	Leland	126	2.94	1.71	.259	1.44	25.5	147	....	25.3	1.50	....	....	A, p. 92.
Lexington	Oil mill	8.06	2.98	14.7	5.60	2.67	8.10	43	....	26.1	1.85	....	....	A, p. 102.
Do	Wilson	200	3.24	1.93	.409	1.35	5.49	257	....	39.2	1.15	....	....	Do.
Lyon (artesian)	....	143	3.3	1.1	.14	1.2	41	155	2.6	38	1.3	....	....	C.
Macon	Macon	363	32.2	9.20	3.47	c 1.83	400	180	....	11.9	.884	....	....	A, p. 45.
Macon, 2 miles E. of	....	326	7.46	4.99	2.10	.0287	328	231	....	10.	.998	....	....	A, p. 46.
Markville (artesian)	....	344	2	3.2	.66	6.9	4	447	4.1	47	....	.69	....	E.
Moorhead	Cotton factory	306	3.51	1.43	1.20	1.76	4.63	401	b 1.87	14.8	.657	....	....	A, p. 85.
Moss Point	Denny	190	1.36	1.64	.357	1.33	144	143	b 1.07	45.8	.798	....	....	A, p. 79.
Ocean Springs (artesian).	....	116	19	22	7.8	Trace.	111	146	(b)	43	....	8.5	....	B.
Ocean Springs	Ocean Springs	172	1.25	1.89	.325	2.75	100	143	1.11	21.9	.748	....	....	A, p. 77.
Pass Christian	Public	155	3.31	.499	.487	1.89	62	154	1.24	22.1	.698	....	....	A, p. 71.
Quitman	Quitman	37.3	5.74	30.1	7.10	3.59	4.63	110	....	36.7	.597	....	....	A, p. 59.
Riverside (artesian; 636 feet deep).	....	45	6.4	3.2	1.4	3.4	4.5	66	....	74	1.5	....	....	F.

[a] A=Miss. Agr. Exp. Station, Bull. No. 89. B=A. L. Metz, Tulane University. C=W. R. Perkins, Agricultural and Mechanical College of Mississippi. D=Illinois Central Railroad. E=B. W. Kilgore, Agricultural and Mechanical College of Mississippi. F=W. L. Hutchinson, Agricultural and Mechanical College of Mississippi. G=J. C. Mims, board of health, New Orleans, La.

[b] Phosphoric acid is taken as P_2O_5.

[c] Sulphuric acid is taken as SO_3.

ANALYSES—Continued.

Analyses of Mississippi waters, in parts per million—Continued.

DEEP WELLS—Continued.

Locality.	Name of well.	Sodium (Na).	Potassium (K).	Calcium (Ca).	Magnesium (Mg).	Sulphate radical (SO_4).	Chlorine (Cl).	Carbonate radical (CO_3).	Phosphate radical (PO_4).	Silica (SiO_2).	Iron and alumina (Fe_2O_3+ Al_2O_3).	Iron (Fe).	Organic matter.	Authority.
Ruleville	Rule Brothers	182	3.63	1.50	.562	1.24	4.63	215	[a]5.06	18.6	0.947			A, p. 86.
Sardis	Railroad	19.9	1.40	14.14	1.44	3.47	19.2	18.3		14.2	.650			A, p. 99.
Scooba	Mineral	297	23.2	510	238	774	934	485		25	2.12			A, p. 51.
Scranton	Waterworks	223	1.50	2.07	.389	1.67	184	139	[a]1.28	21.3	.748			A, p. 78.
Senatobia	Senatobia	8.35	.959	5.06	1.67	2.45	7.82	15.2		15.2	.399			A, p. 101.
Shubuta		460	21	2	1.4	20	4.7	605		21	1.1			F.
Starkville	Starkville	291	8.35	5.11	2.59	1.17	170	510		11.9	([b])	.898		A, p. 40.
Sunflower	Sunflower	245	1.74	1.43	.895	2.13	4.63	320	[a]5.21	42.1	1.90			A, p. 88.
Taylorsville	Taylorsville	172	10.9	1.43	4.32	27.1	26.8	196	2.14	17	.726			A, p. 68.
Tchula (artesian)		227	2.2	2	.30	.17	5.6	296	.96	40				D.
Tunica	Tunica	38.1	3.31	1.21	.517	.657	3.79	51.7	[b].426	32.6	1.78			A, p. 81.
Tupelo	Railroad	38.6	4.69	14.8	2.97	5.83	69.5	21.1		9.98	.099			A, p. 26.
Tutwiler (artesian)		104		3.9	15.6	Trace.	12	169		32	.01			D.
Water Valley	Water Valley	6.27	.800	1.32	.650	1.07	4.31	8.07		11.9	.553			A, p. 106.
Do		14		8			7	23		26				D.
Waynesboro	Waynesboro	397	5.94	2.94	.722	1.64	71.7	465		26.5	1.37			A, p. 61.
Ways Bluff	Allison's	89.2	11.8			149	110			98				A, p. 111.
West		16		34	7	17	6	73		12	10			D.
West Point	West Point	35.5	8.01	9.06	2.17	3.16	6.82	63.5		9.78	2.19			A, p. 33.
Do	368-foot	121	2.88	11.4	2.17	1.23	75.5	487		7.68	.998			Do.
Wortham (artesian; 786 feet deep).		69	Trace.	29	2.3	18	8.2	132		27	3.1	7.6		G.
Yazoo	Main street	141	2.24	.787	.455	1.58	5.90	1.82	[a]1.79	19.4	2.44			A, p. 97.
Do	Waterworks	62.3	5.30	10.7	3.61	12.9	7.58	95.7	[a]1.15	231	16			Do.
Do	A. M. Kolm's	533	22.2	561	459	3160	570	240		23.8	([c])	9.96		A, p. 98.

[a] Phosphoric acid is taken as P_2O_5. [b] Iron bicarbonate is taken as $FeH_2(CO_3)_2$. [c] Iron carbonate is taken as $FeCO_3$.

SPRING WATERS.

Locality.	Name of spring.	Sodium (Na).	Potassium (K).	Calcium (Ca).	Magnesium. (Mg)	Sulphate radial (SO_4).	Chlorine (Cl).	Carbonate radical (CO_3).	Phosphate radical (PO_4).	Silica (SiO_2).	Iron and alumina (Fe_2O_3+ Al_2O_3).	Iron (Fe).	Aluminum (Al)	Lithium (Li).	Organic matter.	Authority.[a]
Meridian	Arundel[b]	13.4	......	1.9	0.40	3.3	4.9	15	......	......	......	......	......	......	......	H.
Baldwyn	Baldwyn	4.12	4.61	3.35	1.37	7.76	2.48	10.4	......	17.6	......	5.93	......	......	......	A,p.25.
Hazelhurst	Brown Well No. 3	80	69	188	71	935	65	147	......	23	......	93	11	......	11	B.
Do	Brown Well No. 4	49	16	250	92	1106	45	117	......	21	......	37	29	......	8.2	Do.
Do	Brown Well No. 5	53	15	142	67	425	79	214	......	40	......	22	12	0.15	8.6	Do.
Do	Lowe's Well	[c]265	21	146	84	745	433	62	......	48	......	2.2	13	......	......	Do.
Blue Mountain	Blue Mountain	.76	1.4	3.8	6.4	4.4	1.2	21	......	11	......	.41	......	......	3.9	I.
Durant	Castalian Springs	65	79	188	52	855	26	......	......	126	83	......	......	......	......	J.
Raymond	Cooper's Well	121	4.7	162	96	936	131	......	......	......	58	......	17	......	......	K.
Weems	Donald No. 2	12	2.4	63	2.4	13	7.5	101	......	12	......	1.5	......	......	......	H.
Do	Mineral Springs No. 1.	4.1	.65	102	3.8	13	9.1	154	......	13	......	.98	......	......	......	Do.
Caledonia	Kolola South Spring.	1.7	4	6.7	2.8	3.6	5.6	35	1.9	9	......	10	......	......	......	F.
Do	Kolola North Spring.	2.2	3.3	6.6	2.0	5.2	5	34	1.9	6.7	......	9.9	......	......	......	Do.
Mammoth Springs	Mammoth Mineral Springs.	6	.68	12	2.4	2.2	7.8	24	......	19	......	......	......	......	5.8	Do.
Bay St. Louis	Park Mineral Springs.	16	1.1	5.6	2.7	5	13	31	......	19	......	3.8	......	......	......	L.
Springs	Pierce Springs	86	......	93	42	14	15	365	......	36	......	13	......	......	......	M.
Robinson Springs	Robinson Springs.	95	17	38	30	178	188	7	......	39	......	3.2	......	......	......	F.
Vossburg	Stafford Springs	9.5	7.6	101	4.7	12	10	159	......	34	......	1.3	......	......	......	B.
Quitman	S.H.Terrell Spring	46.6	3.73	49.3	2.64	6.49	5.88	328	......	32.8	1.4	......	......	......	......	A,p.59.

[a] H=R. W. Jones, University of Mississippi. I=William Krauss, Memphis, Tenn. J=L. G. Patterson, Agricultural and Mechanical College of Mississippi. K=J Lawrence Smith. L=W. F Hand, Agricultural and Mechanical College of Mississippi. M=R. W. Jones, University of Mississippi. For other references see footnote to table of deep wells, above.

[b] Hardness=18.75.

[c] Sodium crenate=5.96.

INDEX.

CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 159.]

The serial publications of the United States Geological Survey consist of (1) Annual Reports, (2) Monographs, (3) Professional Papers, (4) Bulletins, (5) Mineral Resources, (6) Water-Supply and Irrigation Papers, (7) Topographic Atlas of United States—folios and separate sheets thereof, (8) Geologic Atlas of the United States—folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists may be had on application.

Most of the above publications may be obtained or consulted in the following ways:

1. A limited number are delivered to the Director of the Survey, from whom they may be obtained, free of charge (except classes 2, 7, and 8), on application.
2. A certain number are delivered to Senators and Representatives in Congress for distribution.
3. Other copies are deposited with the Superintendent of Documents, Washington, D. C., from whom they may be had at prices slightly above cost.
4. Copies of all Government publications are furnished to the principal public libraries in the large cities throughout the United States, where they may be consulted by those interested.

The Professional Papers, Bulletins, and Water-Supply Papers treat of a variety of subjects, and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Water storage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, Hydrographic progress reports. This paper is the ninetieth in Series B and the fifty-sixth in Series O, the complete lists of which follow (PP=Professional Paper; B=Bulletin; WS=Water-Supply Paper):

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