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DEPARTMENT OF MINES, MINING
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GARLAND PEYTON, Director

THE GEOLOGICAL SURVEY

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GEOLOGY AND GROUND-WATER RESOURCES OF THE ATLANTA AREA, GEORGIA

By

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and

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LETTER OF TRANSMITTAL

Department of Mines, Mining and Geology

Atlanta, November 15, 1949

His Excellency, Herman E. Talmadge, Governor
Commissioner Ex-Officio, State Division of Conservation

Sir:

I have the honor to submit herewith Georgia Geological Survey Bulletin No. 55, "Geology and Ground Water Resources of the Atlanta Area," by S. M. Herrick and H. E. LeGrand, Geologists, United States Geological Survey. This report is the first to be issued upon the ground water resources of the crystalline rocks of Georgia—an area in which the rocks at depth do not readily yield an adequate supply of water.

The information contained in this report should prove helpful in obtaining the maximum available supply of good water for domestic and industrial use in localities within the area which are not supplied by municipal and county distribution systems. Further, these data, together with the free consulting service which is available at the State Geological Survey office, should result in substantial savings annually to those who must finance the development of water systems.

Respectfully,

GARLAND PEYTON
Director

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ABSTRACT

The Atlanta area is in the north-central part of the State and includes Clayton, Cobb, DeKalb, Douglas, Fulton, Gwinnett, and Rockdale Counties. The area includes 2,055 square miles and, according to the census of 1940, had a population of 568,921.

The area lies within the Piedmont Plateau, which is characterized by rolling upland topography broken here and there by stream valleys and high, prominent hills.

The rocks of the area are composed of both igneous and metamorphic varieties that in part have been greatly altered from their original character. Biotite gneiss and schist underlie the major part of the area and form the host rock into which granite has been intruded locally. Large, isolated granite masses and hornblendic rocks underlie most of the remainder of the area.

Ground-water supplies are obtained predominantly from dug wells in rural parts of the area, deriving water from residual material overlying the bedrock. Municipal and industrial supplies in urban areas are derived from drilled wells. The most abundant supplies—other factors being equal—are apparently derived from rocks of the biotite-gneiss series. The principle factors governing the occurrence of ground water in the area are rock type, geologic structure, degree of weathering, and topography. Industrial wells yielding in excess of 60 gallons per minute are considered excellent producers. The quality of ground water obtained in the area varies with the type of rock from which it is derived. The least mineralized water is obtained from granitic rocks, whereas the most mineralized is usually derived from the more basic or hornblendic rocks.

INTRODUCTION

An adequate water supply is, today, of primary importance to every community, and the location and development of satisfactory water supplies constitute an ever-present problem. Water supplies are obtained from three sources—rainfall, surface water, and ground water. Rainfall on roofs or other artificial catchment areas is capable of furnishing only relatively small amounts of water, and the water is subject to pollution. Surface water is capable of large-scale development, but for small-scale development there is the objection of high cost of plant installation and high maintenance cost because of the necessity of sanitary treatment. Ground water, the third of these, remains the cheapest and most sanitary source of municipal supply where it is available in adequate quantity. The conditions under which ground water occurs, the amount of water that is available, and the quality of such water depend largely upon the geology of the area under consideration. The purpose of this report, therefore, is to gather together the available data on the occurrence of ground water in the Atlanta area—its availability, the quantity of water that may reasonably be expected, its chemical quality, and, finally, its suitability for domestic, municipal, and industrial consumption.

Location of the Area

The area studied includes seven counties—Clayton, Cobb, DeKalb, Douglas, Fulton, Gwinnett, and Rockdale—and has been designated the "Atlanta area", inasmuch as the city of Atlanta and its environs form an important part of all these counties. The area includes about 2,055 square miles and is located north and slightly west of the center of the State.

The field work for this report was begun by the senior author in January 1943 and, for various reasons, was carried on more or less intermittently until September 1946. In March 1946, the junior author joined the staff in the Atlanta office and, after completion of a ground-water project on a part of the Coastal Plain of Georgia, he has been able to take an active part in bringing this investigation to completion. In this connection the junior author has assumed the major part of the responsibility for the description of the geology given in this report.

ACKNOWLEDGMENTS

This investigation has been carried on under the supervision of Dr. A. N. Sayre, Geologist in Charge of the Ground Water Branch, United States Geological Survey, in cooperation with the Georgia Department of Mines, Mining and Geology, Captain Garland Peyton, Director. Thanks are due Dr. A. S. Furcron, Assistant State Geologist of Georgia, who has from time to time furnished valuable suggestions concerning the geology of the area. The authors are indebted to Mr. Paul Weir, Director of the Atlanta Water Works, for furnishing data on certain industrial wells in the city of Atlanta. Special thanks are due Mr. W. H. Weir and Mr. N. M. deJarnette, Georgia State Health Department, for data on current municipal supplies and their treatment. Many of the chemical analyses included in this report were made by Dr. L. H. Turner, State Chemist. Finally, the authors are grateful to the many well owners, superintendent of public water supplies, and drillers, particularly Mr. W. A. Martin, of the Virginia Supply and Well Co., Mr. John A. Wood, of the John A. Wood Well Drilling Co., and Mr. B. H. Ragan, of the B. H. Ragan Plumbing & Heating Co., who have furnished valuable data used in this report. Among the superintendents of public water supplies who have been particularly helpful in furnishing data on municipal wells, the authors wish to thank Messrs. Geo. Sparks, East Point; H. E. Whelchel, College Park; E. L. Duncan, Hapeville; O. V. Brown, Jonesboro; M. Waldrop, Forest Park; W. J. Weber, Conyers; and A. S. Johnson, Norcross.

SOURCE OF GEOLOGIC INFORMATION

It was apparent at the outset of this investigation that, to present an ideal interpretation of ground-water conditions throughout the area, a large-scale geologic map—much larger than a mile to the inch—would be necessary. A map of such intricate geology as is characteristic of this part of the State is, of course, not yet practicable because of the long period of time that would be required for its preparation. Variations in the character and attitude of the rocks at intervals of feet, even of inches, are not uncommon, and such small variations cannot be shown on a map of practicable size. That part of the State geologic map of Georgia[1] which includes the seven counties here described is therefore published in this report as plate 1, and the formational names used in this report generally agree with the legend on the plate.

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[1]Geologic map of Georgia, prepared by the Georgia Division of Mines, Mining & Geology, in cooperation with the United States Department of the Interior, Geological Survey.

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CLIMATE

"The climate of any region is largely controlled by its latitude, its proximity to large bodies of water, and by its topo-

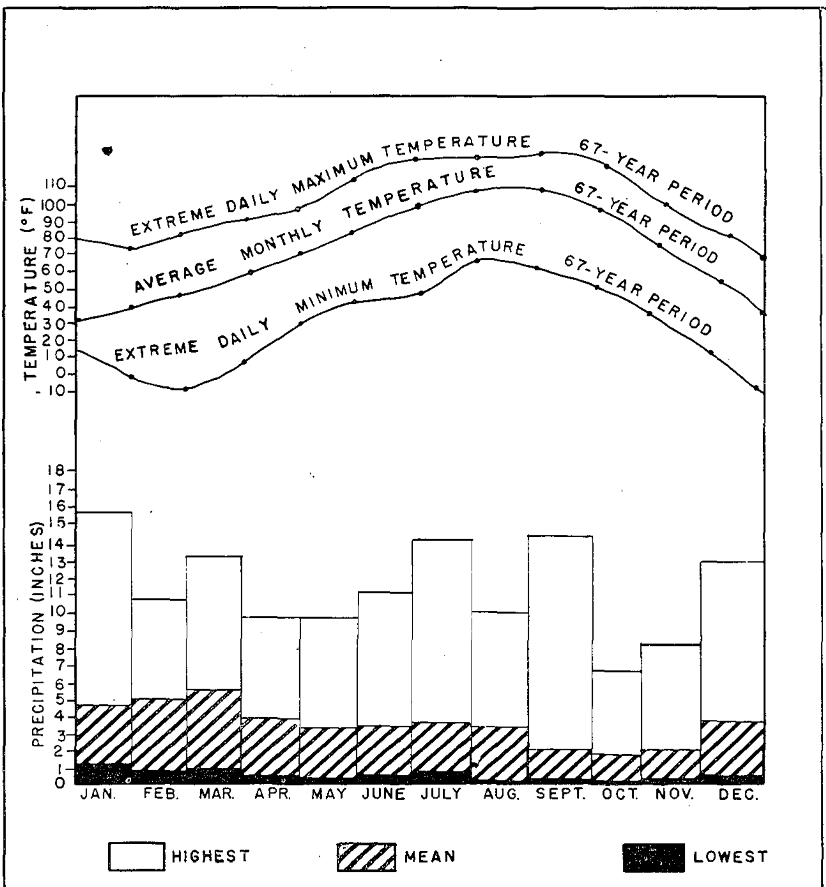

Figure 1. Climatic summary for Atlanta, Georgia. Records precipitation and temperature for 67 year period 1879 to 1946. Based on records of the Atlanta station of the U. S. Weather Bureau.

graphic features."[1] All three factors are effective in determining the climate prevailing in the Atlanta area. The climate of the Atlanta area may be characterized as temperate but humid. The average mean annual temperature for Atlanta is 60° to 61° F., and the average annual precipitation is 48 to 49 inches. Departures from these average figures are shown in figure 1. In general, the months with the highest temperatures are July, August, and September. Highest precipitation usually occurs during the months of January, February, and March, but considerable rainfall occurs also during the summer months of July and August. The driest months usually are September, October, and November.

PHYSIOGRAPHY

The area described occupies a part of the Piedmont Upland, or Piedmont Plateau, a physiographic province bounded on the north by the Appalachian Valley and Blue Ridge provinces and on the south by the Coastal Plain province.

TOPOGRAPHY

The Piedmont Plateau is an upland with moderately strong relief that has been developed by long-continued degradation of an area underlain by crystalline rocks which, in general, are deeply weathered. In localized areas—for example, in a narrow belt bordering the Chattahoochee River—the surface is rugged and extremely hilly. The remainder of the area is a gently rolling plain, broken locally by prominent hills, some of which, in colloquial expression, are "mountains." Such hills constitute residual erosion remnants, or monadnocks, and rise from 100 to 1,000 feet above the general surface. Kennesaw and Stone Mountain are examples of such monadnocks. The upland averages about 1,000 feet in altitude above sea level.

DRAINAGE

Drainage of the upland is, in general, accomplished by streams of two types—those which follow the trend of the underlying rock structure and those which flow across the rock structure and in the direction of the general slope of the upland—that is, to the southeast. Chattahoochee River, the largest stream, flows through the area in a southwesterly di-

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[1]LaForge, L., Cooke, C. W., Keith, A., and Campbell, M. R., Physical geography of Georgia: Georgia Geol. Survey Bull. 42, p. 3, 1925.

rection, tending to follow the regional trend of the rock structure. South River, in DeKalb County, and Mud Creek, a tributary of Flint River, in Clayton County, are examples of streams that flow in the direction of the slope of the upland but across the trend of the rock structure. Allatoona and Noonday Creeks, in Cobb County, flow northwesterly across the rock structure to become a part of the Etowah drainage system. It may be interesting to note that the Chattahoochee River, which marks the boundary between Cobb and Fulton Counties, has with the exception of Peachtree Creek, few sizable tributaries in its course across this area. Another point of interest is that two of the largest river systems in Georgia, those of Flint and Ocmulgee Rivers, head in the Atlanta area. The divide separating these two major drainage systems from that of the Chattahoochee is narrow. This suggests that progressive reduction of the divide has occurred, and may possibly result in future beheading and capture of the upper reaches of the Chattahoochee River system by the Flint and Ocmulgee systems. It appears that, through headwater erosion by the Flint and Ocmulgee drainage systems, the divide has been pushed steadily northward until, at the present time, we find it surprisingly close to the Chattahoochee River itself. This seems to account for the fact that few sizable tributaries enter the Chattahoochee from the south.

The divides between the major drainage systems take the form of long, rather sinuous ridges. Along them lines of communication, such as railroads and highways, and centers of population tend to be concentrated. The cities of Atlanta, College Park, and East Point, for example, are situated on such a divide, which is traversed by U. S. Highway 29 and by the Central of Georgia Railway.

OUTLINE OF THE GEOLOGY

The rocks of the area described are largely igneous and metamorphic; the latter have been greatly altered from their original character and are now intermingled with the igneous rocks in an intricate manner. The rocks of the area are generally known as "crystalline" rocks.

A group of rocks composed chiefly of biotite gneiss and muscovite schist form the host rock into which later igneous rocks have been intruded. The intrusive rocks are chiefly granites, although intrusions of hornblende gneiss, pyroxenite, and pegmatite are fairly common. In general, these intrusions conform to the foliation (schistosity) of the older rocks. The age relations of the rocks are not entirely clear. The biotite gneiss and schist probably are of pre-Cambrian age. The pyroxenite and hornblende gneiss are younger than the biotite gneiss and schist, but are older than some of the granites. Although the granites are generally separated according to differences in texture and composition, the field relationships do not indicate that they are all of separate age. Some of them are doubtless of late Paleozoic age. The igneous rocks have intruded the biotite gneiss and schist, forming separate bodies as well as thin intercalated stringers in the host rock. This intermingling of rock types has produced what is called an injection complex. The youngest rocks of the area are thin dikes of diabase, intruding all other rock types and generally cutting across the regional strike. These rocks are probably of Triassic age; they represent an insignificant portion of the crystalline complex.

STRUCTURE

The older rocks underlying the area show evidence of extreme deformation. Several early periods of deformation altered the character and disposition of these rocks, but these earlier structural characteristics were subsequently modified or obliterated by intensive folding and overthrust faulting—phenomena typical of the Appalachian region and which geologists generally agree, occurred near the close of Paleozoic time. The displacement of beds was to the northwest, but it is difficult to locate many fault zones because close folding preceded much of the faulting, allowing most of the displacement to occur parallel with the beds. As a result, the general dip of the schistose and gneissoid rocks is toward the southeast. A few overturned folds to the northwest, representing late stages of Appalachian deformation, give evidence of the direction of structural movement. Key beds, therefore, normally can be traced only for relatively short distances. The emplacement of certain igneous bodies into the older schists and gneisses at the time of, or following, the late Palezoic folding and faulting has forced the host rock to make room for the injected rocks, and, consequently, the nearby host rock locally shows considerable variation in strike and dip.

GROUND WATER

Source and Occurrence

Of the precipitation that reaches the ground, a part returns to the atmosphere through direct evaporation, a part runs off in the form of surface streams, and a part seeps downward into the soil and the rocks underlying the soil. Part of the water that seeps into the ground later evaporates directly or is returned to the atmosphere by transpiration of plants; the remainder percolates slowly downward through an incompletely saturated zone, known as the zone of aeration, until it reaches a zone in which the interstices in the soil and rocks are completely saturated. This zone of saturation is the source of the water supplies of wells and springs. The top of the zone is known as the water table.

The occurrence of ground water in the Atlanta area is dependent upon many different—though in part closely related—factors. Among these factors are rock type, structure, weathering, and topography.

Rock type.—A classification of the rocks of the Atlanta area according to their mineral constituents reveals a number of well-recognized rock types. However, in general, the primary characteristics of the different types of rocks are of little significance in the occurrence and movement of ground water, as all the rocks consist of mineral grains that are so closely interlocked as virtually to deny access to ground water.

The various rocks, however, react differently to forces imposed on them following their formation, and openings capable of transmitting water are developed in some of them to a much greater extent than in others. These openings are associated mainly with primary and secondary structures and with weathering. When secondary changes are considered, rock type may be said to have considerable significance.

Structure.—Almost all crystalline rocks have some structural planes along which openings capable of transmitting water exist or are eventually developed. Structural planes important in the occurrence of ground water in this class of rocks include those due to faulting and folding (the latter resulting in so-called planes of schistosity), intrusive contacts, and, finally, joints and other fractures. In Georgia the most prominent planes along which ground water can occur are those due to schistosity, which have a prevailing northeast trend and a relatively steep southeasterly dip. So close and intense has been the folding in the Atlanta area that existing structural planes are parallel, and folds are seldom evident. In places the close folds have given way to definite breaks, or faults, the fault zones generally trending parallel to the bedding, or schistosity. Furthermore, because of this parallelism and of the fact that, for the most part, the fault zones are not characterized by large openings, they are not always distinguishable from the planes of schistosity. In this connection, because the faults in the Appalachian area are generally of the overthrust type, ground water along them, which might issue as fault-zone springs, cannot find access to the surface; the overthrust block smothers the water-bearing fault zone, preventing ground-water discharge as fault-zone springs; consequently, such springs are practically nonexistent in this area.

Numerous intrusive masses affect the circulation of ground water in their vicinity. Where the igneous material is injected into the host rock, ground water normally finds access along the contacts, the openings along them normally yielding moderately large quantities of water to wells that intersect them. These intrusive bodies range in width from several miles to a fraction of an inch. In composition they range from granite to hornblendite.

Joints and shear fractures traverse almost all crystalline rocks, furnishing places for storage of ground water. Openings of this kind are more common in metamorphic than in igneous rocks. However, the widespread occurrence of nearly flat-lying joints constitutes a phenomenon which is of great importance with respect to ground-water conditions in igneous rocks, especially in granites. Openings of this kind are due to exfoliation, or sheeting. They are generally conformable to the surface topography but have less relief. Exfoliation produces rock sheets of variable thickness on the uplands, their surfaces convex upward. Their form is ideal for allowing drainage to the lowlands. In the lowlands, on the other hand, exfoliation planes are concave upward, forming shallow pseudosynclinal basins—ideal receptables for the collection and storage of ground water. Metamorphic rocks do not exfoliate readily, but prominent parting planes have been observed in gneissoid rocks of relatively low inclination. The observed parting planes are parallel with the gneissic banding and are thought to represent exfoliation in this type of metamorphic rock. Where exfoliation is present in steeply inclined gneisses, it is not parallel to the gneissic banding.

Weathering.—The effects of long-continued weathering on the crystalline rocks of the Georgia Piedmont are everywhere evident. These rocks have been deeply weathered and are therefore covered by a rather thick mantle of residual material, commonly designated mantle rock. This surface residuum furnishes appreciable storage space for ground water. The mantle rock is thickest in the lowlands, owing to more intensive decomposition because of deeper and more continuous penetration of moisture there. It should be emphasized here that the mantle rock is the result of weathering **in situ;** virtually none has been transported from higher slopes.

Although exfoliation was treated as a structural feature, one theory of its origin is that it is due, at least in part, to weathering. However, the subject is beyond the scope of this report.

Topography.—The fourth factor here considered important in the occurrence of ground water in crystalline rocks is topography. It should be noted that in the lowlands the rocks contain greater amounts of ground water than are found beneath the uplands. This has been pointed out by Furcron,[1] Mundorff,[2] and others. The most probable reasons for relatively large supplies of ground water in the lowlands are as follows: (a) Less surface runoff and consequently more direct influent seepage occurs in the valleys, owing to the flatter terrain. (b) Influent seepage occurs from upland surface runoff, only part of which is confined to surface channels. (c) Influent seepage occurs from upland rock slopes beneath the residual material. The gradient of the water table is, of course, toward the lowland, resulting in continuous recharge

[1]Furcron, A. S., Geology of the Warrenton quadrangle, Virginia: Virginia Geol. Survey Bull. 54, p. 71, 1939.

[2]Mundorff, M. J., Progress report on ground water in North Carolina: North Carolina Dept. Cons. and Devel., Div. Min. Res. Bull. 47, p. 14, 1945.

there. (d) Greater void space is available for storage of ground water, as a greater thickness of residual material is commonly present. (e) Many valleys are associated with faults and other parting planes along which water circulates, and in some areas this factor doubtless is more important than any other in regard to the availability of ground water. Mundorff[3] regards the latter as of considerable importance in North Carolina.

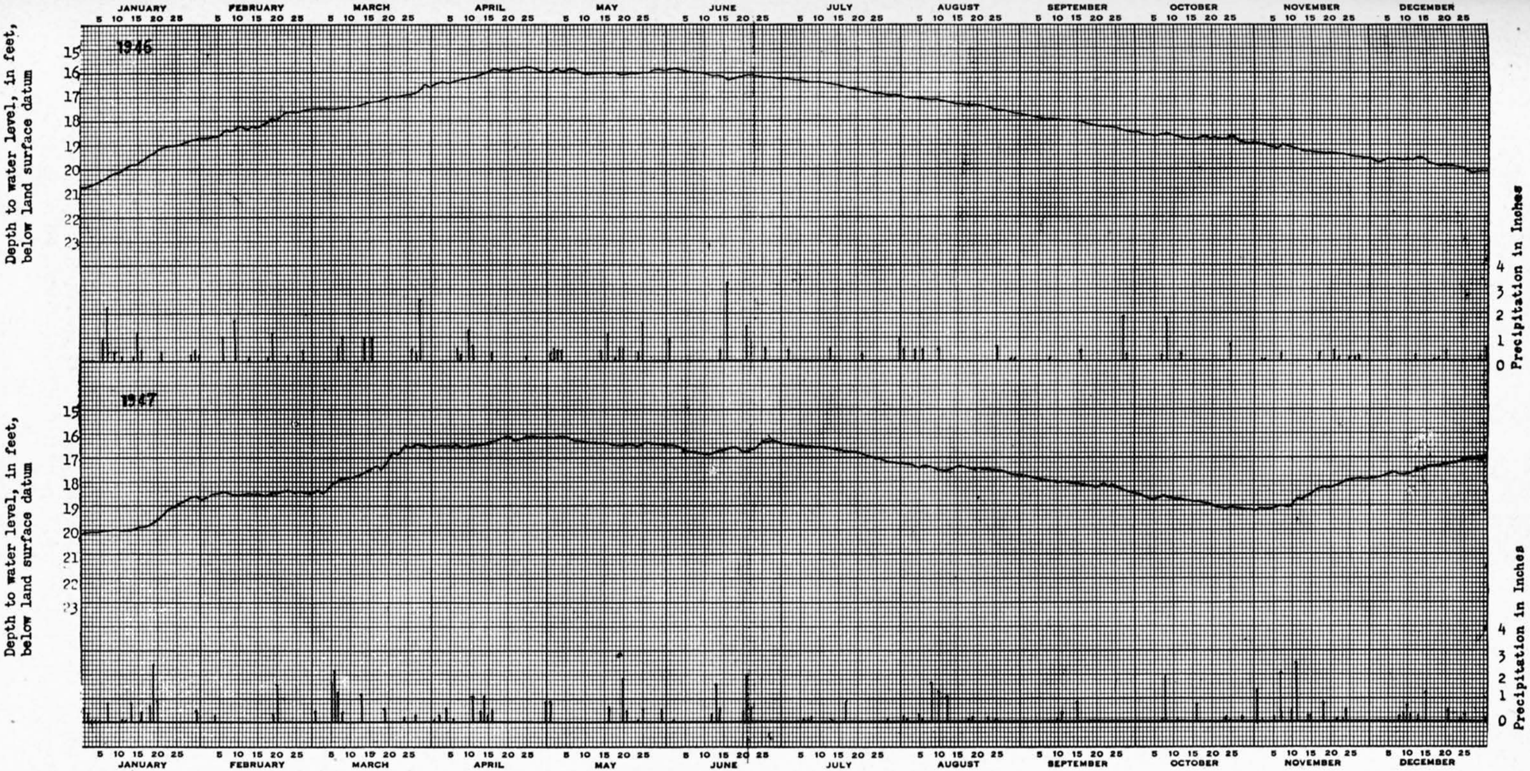
Fluctuations of the Water Table

The depth to the water table in any area and the way in which it fluctuates depend on a number of factors, chief of which are the kind, amount, and distribution of precipitation; other climatic features such as cloudiness and wind movement; structure, permeability, and storage capacity of the underlying soil and rocks; kind of vegetation; and topography. In an area such as the Atlanta area the water table conforms in general to the configuration of the surface topography, although its relief is more subdued.

The position of the water table shows seasonal variation as well as variation from place to place, in accordance with the relation between recharge and discharge at a particular time; that is, when recharge exceeds natural and artificial discharge the water table rises, and when the reverse is true the water table declines. For example, greater rainfall and less evaporation and transpiration during the late winter months contribute toward higher water levels during March, April and May in the Atlanta area. Figure 2 shows seasonal fluctuation in water level in a typical well in Atlanta. A close correlation between the water levels in this well and the precipitation is evident.

Fluctuations differ also from well to well, the proximity of the well to a main drainage channel and its position in relation to the topography of the surrounding country determining, in large measure, the fluctuation of its water level. For example, in DeKalb County, well 40, which is near a small perennial surface stream, had a total fluctuation of only 0.81 foot for the year 1946, whereas well 39, which is not near a surface stream, had a total fluctuation of 5.05

[3]Mundorff, M. J., op. cit., p. 16.



Hydrographs showing fluctuations of water level in Well 26, Fulton County, during 1946 and 1947. Precipitation plotted from records of nearest U. S. Department of Commerce, Weather Bureau station, Atlanta Airport.

Figure 2. Hydrographs showing fluctuations of water level in well 26, in Fulton County, during 1946 and 1947.

feet during the same year. Again, in Cobb County, well 83, which is in a broad valley, had a total fluctuation of 1.86 feet during the year 1946. On the other hand, well 85, which is on top of a high hill, had a total fluctuation of 11.42 feet for the same year, and this difference existed in spite of the fact that the two wells are near each other.

In the area described the water table is generally less than 60 feet beneath the surface of the ground and averages approximately 30 feet. Contrary to popular belief, the water table does not become lower each successive year, except in local areas where more water is pumped out than is replenished. In support of this view the reader is referred to the water-level reports published annually by the Federal Geological Survey as water-supply papers.[1] Data incorporated in these reports are supplied from observation wells, which are strategically located in the Atlanta area and are systematically measured several times a year.

Effect of Pumping on Water Levels

Pumping a well lowers the water level in the well, draws water from the water-bearing materials immediately surrounding the well, and forms what is known as a cone of depression in the water table or the piezometric surface.[2] As a result of the formation of the cone of depression, ground water moves in toward the well to replenish the water extracted by pumping. The area in which the water table or piezometric surface is affected by pumping is known as the area of influence. When the rate of pumping exceeds the rate of replenishment the area of influence becomes larger and the cone of depression deeper until sufficient recharge is intercepted to balance the withdrawal. Figure 3 shows the drawdown in a well penetrating crystalline rocks and pumped at the rate of 120 gallons per minute over a period of 96 hours. Although this well lies outside the Atlanta area, its

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[1]For the Atlanta area, Water-Supply Papers 886, 907, 937, 945, 987, and 1017, for the years 1939-44. Papers for later years in course of publication.

[2]The term piezometric surface is used for areas of confined (artesian) water, where a free water table does not exist. It is the imaginary surface, whether above or below the land surface, representing the height to which water will rise in wells penetrating the confined aquifer.

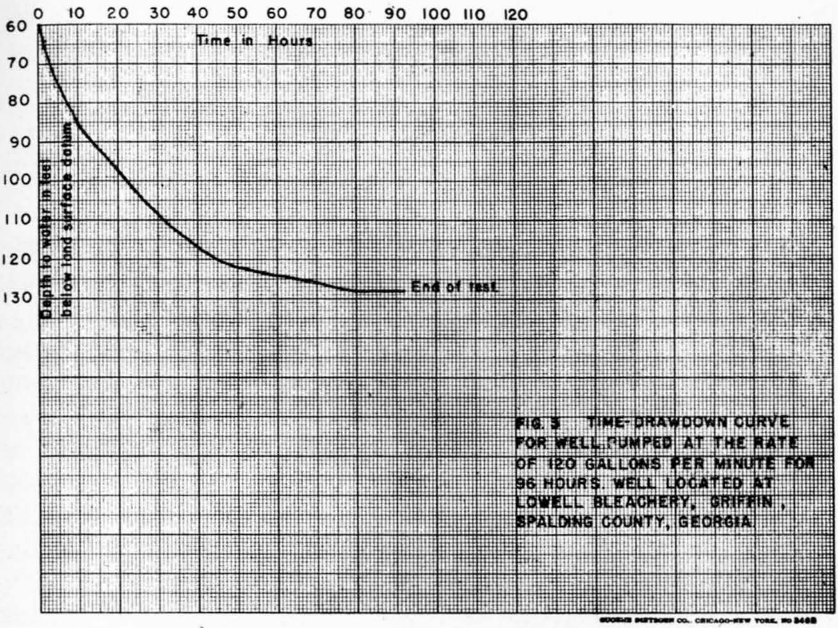

Figure 3. Time-drawdown curve for well pumped at the rate of 120 gallons per minute for 96 hours.

description is included because of the long pumping test to which it was subjected and because the authors consider it typical of wells in areas of crystalline rocks. In figure 3 it should be noted that, during the early stages of pumping, drawdown was rapid, but with continued pumping the drawdown progressively decreased until a level of apparent equilibrium was reached. Additional pumping at the same rate apparently did not further lower the pumping level in the well to any appreciable extent. However, in spite of the apparent level of equilibrium established in this well between discharge through pumping and recharge by water entering the cone of depression, a progressive lowering of water level has been noted in some wells that have been heavily, and more or less continuously, pumped over a period of years. For example, well 1 in Rockdale County reportedly showed in 1940, 1943, and 1948 pumping levels of 134, 160, and 190 feet, respectively—a total lowering in pumping level of 56 feet in 8 years, without an increase in the rate of pumping. In many wells in the Atlanta area pumping levels have declined so low over a period of years as to make further pumping of these wells impracticable. The question now arises as to the causes responsible for the condition described.

Overpumping of wells and silting up of voids feeding the wells represent two causes which might account for the progressive lowering of pumping levels and consequent decline in pumping yields.

A state of overpumping is reached when the rate of discharge exceeds the rate of replenishment, or recharge. This condition is realized when the cone of depression becomes too deep for economical pumping; or when it extends to the areas of recharge and natural discharge, but the lowering there is not able to induce enough additional recharge or cut off enough natural discharge to make the net rate of recharge equal to the withdrawal. In the Atlanta area the practicable limit of pumping lift generally would be reached long before the cone of depression could expand fully to develop all sources of recharge and cut off all natural discharge. Thus, in effect, a given well can be pumped at only such a

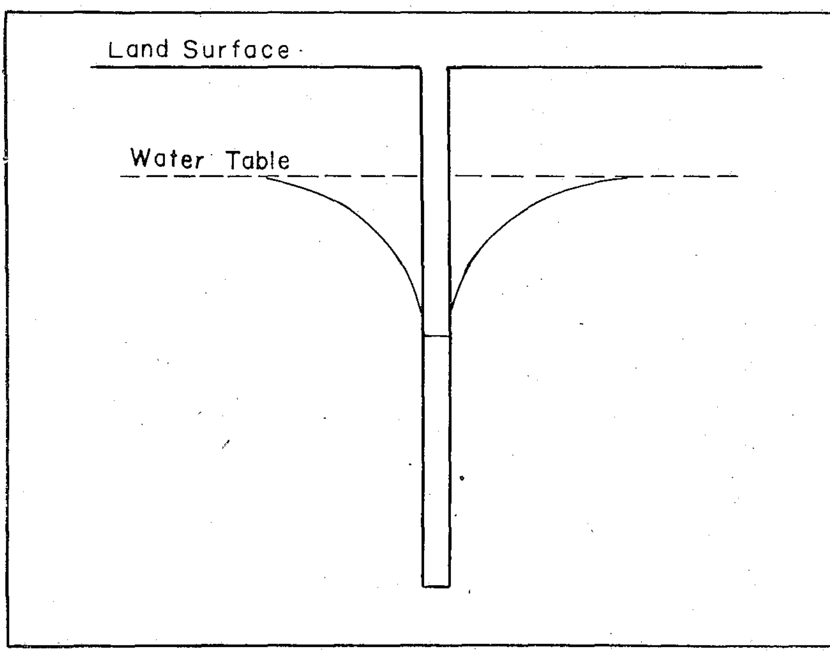

Figure 4. Section showing theoretical cone of water-table depression in a well penetrating homogeneous material.

rate as will keep the pumping water level within reach, and yet permit the cone of depression to expand sufficiently to intercept the necessary recharge. In other words, the area of recharge is visualized as local in character; such areas of recharge amount to nothing more nor less than local underground reservoirs which are drawn upon by wells. These underground reservoirs differ in size from place to place, depending upon the horizontal extent of the water-bearing openings composing them.

Figure 4 shows a cone of depression developed in a homogeneous aquifer. Such a cone is characterized by gently sloping sides. On the other hand, in the Piedmont area, which consists of crystalline rocks overlain by a mantle of residuum of variable thickness, pumping tends to lower the apex of the cone of depression into the less permeable bedrock. When this stage is reached the cone of depression resembles that formed in homogeneous rocks (fig. 4). If, through continued pumping, the cone of depression is lowered into the bedrock, the sides become decidedly steeper (fig. 5). As a result, the

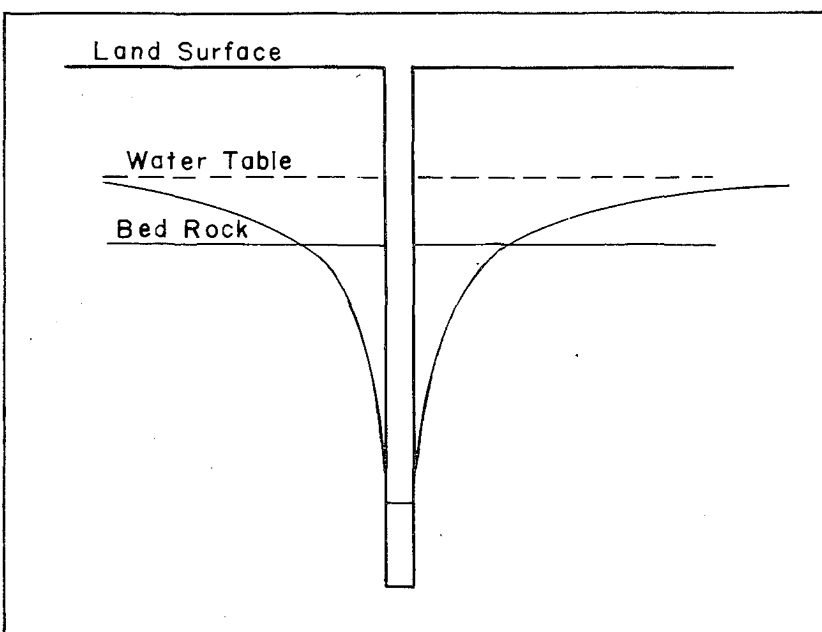

Figure 5. Section showing theoretical cone of water-table depression in a well penetrating crystalline rocks overlain by residual material.

cone of depression does not expand laterally as rapidly as it would in homogeneous material, and a relatively large lowering of the water level is required to induce a small growth of the cone. In such a case the yield is limited to about the amount that can be pumped when the water level is near the bottom of the mantle rock. Continued overpumping under these conditions results in further steepening of the cone of depression and eventually in near-exhaustion of the water within the well area. It is thought that this condition can be overcome only through a long period of rest, during which recharge can take place and the water levels in the wells can return to their normal stage. To avoid such a condition in the first place, wells in these areas should not be pumped at a rate greater than the effective rate of recharge, as limited by the character of the aquifer. It is probable that the rate of recharge in typical areas could be estimated through experimentation and long-continued pumping tests. However, until more intensive research is conducted on the hydraulics of crystalline rocks, no concrete estimate can be given.

It is conceivable that silting up of the fractures that feed wells penetrating crystalline rocks might occur through entrance of fine, insoluble material from the overlying mantle rock. Heavy pumping probably would tend to increase such silting action, although in special cases it might help to clear the crevices. Another factor contributory to this condition is the closure of existing voids through weathering of the fractured rocks, as the products of weathering are generally bulkier than the fresh rock. The formation of a cone of depression during pumping would have a tendency to expose to weathering rock surfaces within the cone which, under natural conditions, would be weathered much more slowly.

Yields and Locations of Wells

In the past, wells in the Atlanta area have generally been located with three considerations in mind—quantity of water available, convenience of location, and, finally, quality of the water. Here it should be noted that quantity of water available and convenience of location do not necessarily go hand in hand.

Ellis[1] reports an average yield of $17\frac{1}{2}$ gallons per minute from wells drilled in crystalline rocks in Connecticut. Mundorff[2] cites 16 gallons per minute as the average yield from wells in a similar area of crystalline rocks in North Carolina. Although these figures are true for the wells described in Connecticut and North Carolina, they may be too high for existing wells in Georgia. Most wells in Georgia have been located primarily for the sake of convenience, predominantly on hills and uplands. Field data on wells in the Atlanta area illustrate the fact that greater quantities of water can be obtained from wells in lowlands than from wells on the uplands. For example, at Ben Hill, in Fulton County, two wells were drilled recently on contrasting topographic sites. The first or upland well reached a depth of 500 feet without producing any appreciable quantity of water. The second well, only a relatively short distance away but in a lowland, yielded 144 gallons per minute at a depth of only 95 feet. It seems safe to say that, with an equal distribution of wells on lowlands and uplands, the average expected yield from crystalline rocks in Georgia might be much higher than the present averages.

Both the chemical composition and the sanitary quality of well water deserve consideration. Freedom from contamination is insured when a well is so located that pollution cannot gain access to the water-bearing fissures feeding the well. In the Atlanta area, the blanket of surface residuum usually acts as a natural filter, insuring to some extent the entrance of pure water into the fissures and joints of the lower-lying bedrock. However, if a well is located in an area where little or no surface residuum exists, the possibility of pollution is greatly increased. Although pollution would tend to be concentrated in the lowlands by gravity. the thicker mantle rock characteristic of such terrains should, under normal conditions, inhibit or prevent contamination of ground water there. It is believed, therefore, that cases of contamination in wells situated in lowlands represent more or less special, localized

[1]Ellis, E. E., A study of the occurrence of water in crystalline rocks, in underground water resources of Connecticut: U. S. Geol. Survey Water-Supply Paper 232, p. 101, 1909.

[2]Mundorff, M. J., Ground water in the Halifax area, North Carolina: North Carolina Dept. Cons. and Devel. Div. of Min. Res. Bull. 51, pp. 19-22, 1946.

conditions. Such instances probably are due to proximity of sources of heavy pollution and to poor well construction.

The location of a successful well in an area underlain by crystalline rocks should not be left to chance. The study of producing wells with respect to their location has indicated that several factors govern their production. Where relatively high yields are desired, the following comments may prove helpful:

(1) More water from precipitation can seep into the soil and gain access to openings in the rocks on a level than on a hilly surface. For this reason it is generally advantageous to select a well site on level ground in a valley or on relatively level upland terrain that is not readily drained. Hilly country generally is well drained, so that less ground water remains in storage. Also, hilly terrain encourages rapid surface runoff, reducing the amount of influent seepage to the water table. For example, a belt several miles wide bordering the Chattahoochee River in Cobb and Fulton Counties has relatively hilly topography. Within this belt the conditions are generally unfavorable for large ground-water supplies.

(2) Although all rocks in the Atlanta area display some kind of fracturing, the more homogeneous types, particularly the granites, exhibit a special type of nearly horizontal fracturing known as exfoliation or sheeting. Experience has shown that openings along the parting planes are excellent receptacles for the collection and storage of ground water in lowlands.

(3) Most of the rocks in the area, especially the more schistose varieties, have a general southeast dip. In an area of southeasterly dips a great part of the water entering a well falls on the land surface only a short distance northwest of the well. The water seeps downward through the soil to bedrock, where much of the water is deflected southeastward along the schistose planes, to be subsequently intercepted by the well. It follows that the intake area is close to a well where a steep dip prevails, and, other things being equal, far from the well where the dip is gentle. A successful well is one whose intake area contributes considerable water to it. If the strata comprising the intake area for a well crop out on a steep hill where runoff is great and where the influent

seepage is therefore relatively slight, the well will, in all probability, be a small producer. Hence, it would seem advisable to locate a well in such a manner as to intersect water-laden schistose openings that have adequate access to influent seepage. (See fig. 6.) Where southeast dips prevail, many successful wells are located on the southeast slopes of the valleys.

(4) Wells located in areas of gentle dip intersect more parting planes along which ground water occurs than those situated where steep dips prevail. Further, the openings between beds of low dip tend to be larger than those of steeply dipping rocks. For these reasons, more ground water generally may be recovered from gently dipping beds. For example, southeast of the Chattahoochee River the rocks have a gentle southeasterly dip, whereas the rocks northwest of the river generally are rather steeply inclined. Wells southeast of the Chattahoochee River have noticeably greater yields than those northwest of the river. However, where the dip is nearly vertical, the entrance of water into the ground may be relatively easy. (figure 7).

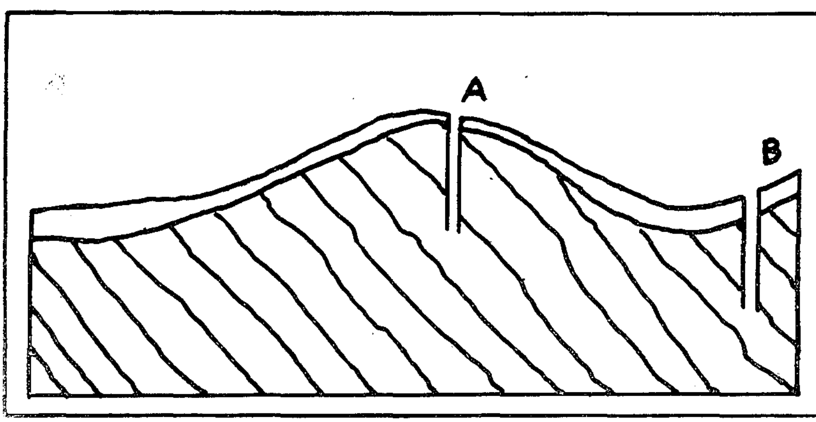

Figure 6. Diagram showing importance of schistose planes in the yield of wells drilled in schist and gneiss. Well at B has a better chance of being successful than well at A. Because of rapid surface runoff of precipitation on hill, only a limited amount of water is accessible through seepage into well at A. Well at B derives seepage from adjacent valley through connecting schistose openings.

(5) Whenever practicable, a well should be located in rock of a type which is known to yield water to existing successful wells. For example, the biotite gneiss and schist form a bet-

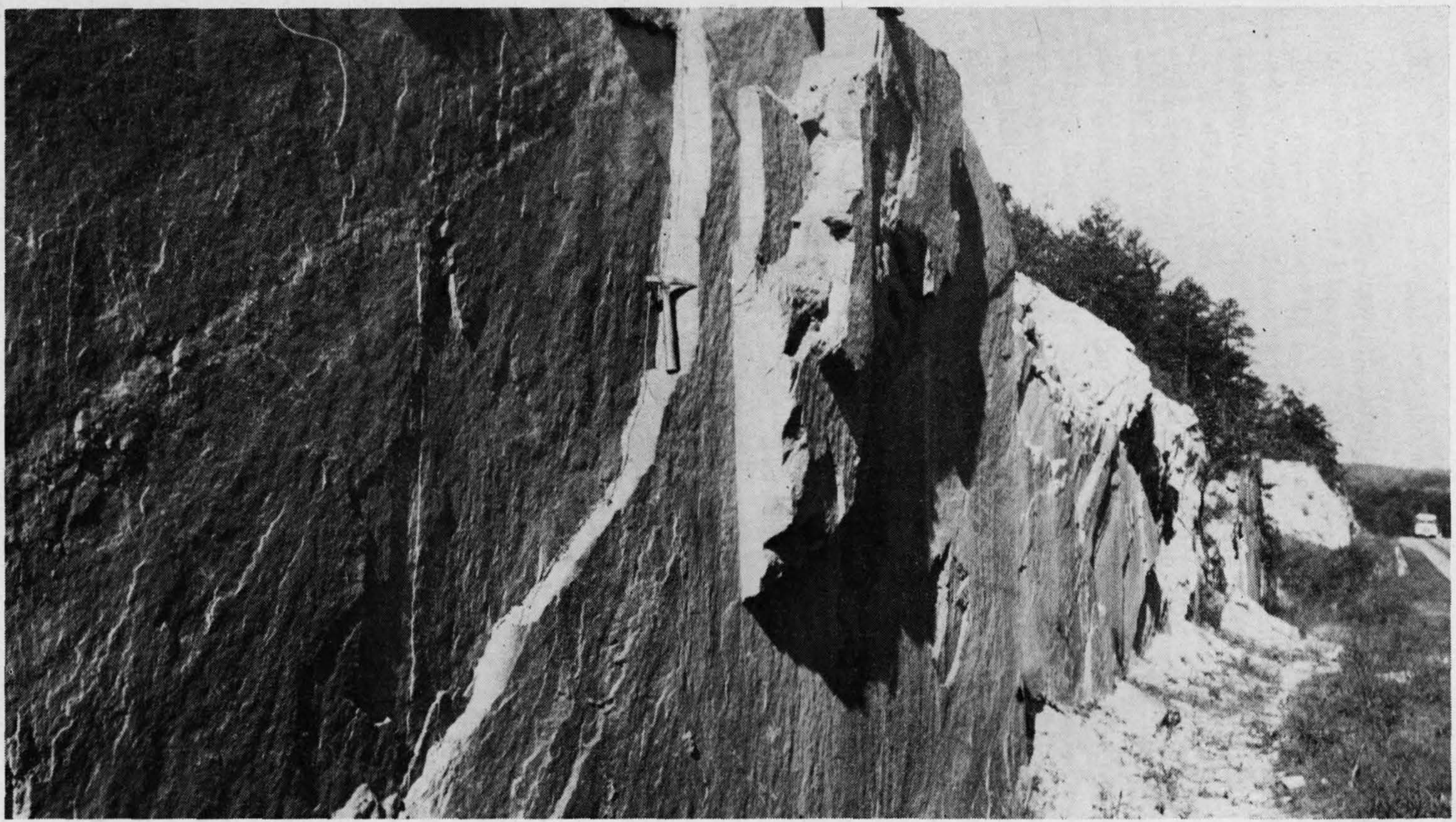

Figure 7. Vertical joints transverse to the schistosity in biotite gneiss, Marietta Highway near Chattahoochee River, Fulton County.

ter aquifer than the Brevard schist. East Point and College Park, to cite two examples, are underlain by biotite gneiss and the wells there yield relatively large amounts of ground water as compared with those in other parts of the Atlanta area. Figure 7[1] shows the closely spaced vertical joints typical of the gneiss, which in part are responsible for its favorable water-bearing character.

(6) The spacing of wells in such a way as to avoid interference through pumping is important. Here the importance of determining the direction of movement of ground water under natural conditions and during pumping should be emphasized. The shape of the area of influence of a well in the Atlanta area varies according to the direction of flow into the well. Generally speaking, the area of influence will be elongated in the direction of the strike of the underlying rocks. It follows that a well 200 yards from a heavily pumped well and along the same strike would probably be affected considerably, whereas another well located 50 yards from the pumping well but across the strike would be less affected. However, no hard and fast rule has been devised that will fully solve this problem.

Artesian Conditions

Artesian conditions exist where ground water passes between impermeable beds and is confined there. In this sense true artesian conditions are extremely rare in crystalline rocks and, therefore, have no great significance in the Atlanta area. The reasons for this are principally two: (1) Fracturing of the rocks is imperfect and more or less random but is widespread, so that extensive bodies of tight rock overlying fractured rock are rare. (2) As a result, areas of recharge are relatively close to areas of discharge, so that only slight pressures are built up even where the water passes beneath impermeable bodies of rock.

Faults or other extensive fractures through which water can move long distances from a relatively high intake area and which may be intercepted by drilled wells at lower levels, may furnish artesian water, which possibly will flow above the surface of the ground. An example of this kind in Wilson County, North Carolina, has been described by Mundorff.[1] Small artesian flows can be obtained in some places in the

[1]Mundorff, M. J., op. cit., Bull. 51, p. 23.

a. Perennial sheet spring.
b. Intermittent sheet spring.
c. Unsuccessful well.
d. Successful well.
e. Possible flowing well.

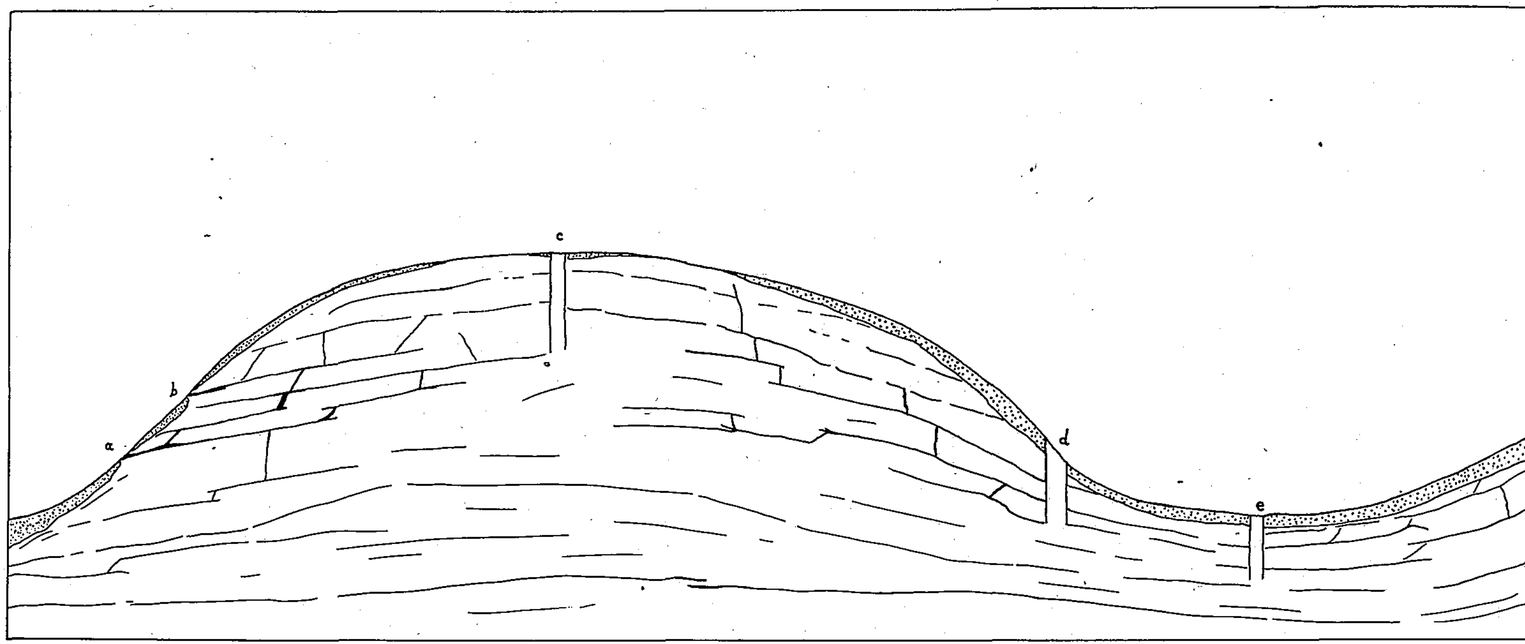

Figure 8. Cross-section of sheeted terrane showing water-filled joints in heavy dark lines.

Figure 9. Exfoliation in granite at Stone Mountain quarry, DeKalb County, Georgia.

Atlanta area, particularly in granite areas, where exfoliation produces large and extensive openings. Ground water moving down from the convex exfoliation openings of the hills into the concave openings of the valleys may have sufficient head to cause feeble flows. Well 47, in DeKalb County, is an excellent example of a well having an artesian flow of this kind. Figure 8 illustrates the conditions under which flows may occur. Figure 9 is a photograph showing foliation in a granite quarry at Stone Mountain.

Utilization

The type of well utilized in the Atlanta area, as in other areas where water-table conditions prevail, depends upon several factors—depth to the water table, character of the water-bearing rock, amount of water desired, and cost of construction. In the Atlanta area dug and drilled wells are the types generally in use. Of these two types, dug wells supply by far the largest part of the water utilized in rural areas, whereas drilled wells generally are used in the relatively thickly populated and industrialized areas. In addition to wells, springs also are used for domestic and, in some instances, municipal supplies.

Dug Wells

Dug wells are shallow in comparison with drilled wells, averaging about 30 feet in depth and approximately 3 to 4 feet in diameter in the Atlanta area. These wells obtain their water supply mainly from the mantle rock or from alluvial deposits along the main streams traversing the area. The amount of water furnished by wells of this type varies according to the depth to which they extend below the water table, the surface topography, the amount of precipitation, and the character of the material penetrated. Yields from dug wells are low, generally ranging between 2 and 5 gallons per minute. Such amounts are suitable, however, for average household needs. Also, because of their relatively large storage space, dug wells act as reservoirs, so that a well capable of a sustained yield of a gallon per minute, or even less, may be adequate for domestic supply.

It is interesting to note a special application of this type of well. The Fulton Bag and Cotton Mill Company in Atlanta is now using a dug well which is reportedly 94 feet in depth. From the main shaft two galleries extend laterally. One is reportedly 110 feet in length and 5 feet in diameter. Water from this system is now being used for air-cooling purposes. The water supply from this set-up, however, is only partially satisfactory. According to report, about 70,000 cubic feet of water (525,000 gallons) is obtained during the week's pumping, after which the water supply of the well apparently is almost completely exhausted, and the well must be allowed to recover over the week-end.

Drilled Wells

Drilled wells in the Atlanta area range in depth from about 50 to 1,000 feet and in diameter from 3 to 12 inches. Yields range from a few gallons to as much as 470 gallons per minute. The factors controlling the amount of water obtained from this type of well are essentially the same as those mentioned in the discussion of dug wells, but with certain differences. Water-level records for drilled wells show less daily fluctuation than do those for dug wells. A possible explanation of this may be the fact that drilled wells penetrate more deeply below the water table, and obtain a part of their water from a considerable depth, so that there is some lag in the effects of both wet and dry weather. Drying up of drilled wells during periods of drought is therefore less likely to occur. Another difference is that many deeper drilled wells show a progressive decline in yield over a period of years, whereas dug wells do not, as a rule, show a decline. This is because the water level may be drawn much lower in a deep well and the local water supply may be overdrawn more readily than is the case for a dug well. Finally, as regards quality, drilled wells generally yield more highly mineralized water than do dug wells.

Springs

In the Atlanta area springs are generally of the gravity type; that is, they occur where the land surface intersects the water table on low ground, or where impermeable rock deflects the water laterally so that it emerges from a hillside. They are common on valley slopes where the contact of the residuum with the underlying bedrock lies at or near the surface. Apparently, therefore, most of the spring water is derived from surface residuum. Generally speaking, springs of this kind represent nothing more than concentrated leakage of ground water that has entered the residuum at a higher elevation.

Some spring water emerges directly from fractures, generally of low inclination, in the bedrock. Where the land surface intersects water-filled openings, such as those along exfoliation planes or other gently inclined subsurface fractures, springs will occur. Also, springs along faults should be mentioned. Because faults of the Atlanta area are of the overthrust, or reverse type, springs due to faulting are rare. The overthrust block tends to smother the water-filled fault zone and so to prevent the emergence of the water as springs.

Many springs of the Atlanta area have gained considerable popularity in the past because of their mineral character. Springs of this kind, generally known as "Mineral Springs", have been described in some detail by McCallie.[1] The water of most of them is not highly mineralized; in fact, some of the most highly regarded spring waters are of very low mineral content.

Because spring waters are generally soft, they are suitable for most types of consumption. Springs are utilized chiefly for domestic purposes, but in some instances they constitute sources of municipal and industrial supply. However, only a small part of the existing springs have thus far been used, particularly as sources of industrial supply. Their generally inaccessible location in valley bottoms and generally small yield probably are chiefly responsible.

Yields from typical springs in the Atlanta area range from a fraction of a gallon to about 25 gallons per minute. Topographic location is one of the important factors determining the perennial yield. For example, hillside springs may become completely dry during droughts or during certain seasons of the year when the water table stands at relatively low levels. On the other hand, springs along streams and in valley bottoms may flow throughout the year and with little appreciable variation in the flow. In spite of relatively low yields and seasonal fluctuations in flow, springs remain an important and hitherto largely undeveloped source of water supply.

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[1]McCallie, S. W., A preliminary report on the mineral springs of Georgia: Georgia Geol. Survey Bull. 20, 1913.

QUALITY OF GROUND WATER

Introduction

The character of a crystalline rock affects the chemical composition of ground water derived from it. The part of the precipitation which percolates downward through the soil and rock crevices to become ground water dissolves certain mineral matter characteristic of the rock through which it passes. Whereas in many cases the amount of dissolved mineral matter is small, and therefore unobjectionable, in others an excess of certain components makes the waters unsuitable for a particular use.

Much of the area described is underlain by highly siliceous rocks which are relatively insoluble in pure water, but which in the presence of water containing carbon dioxide are subject to some degree of chemical change. Water derived from granites is normally low in dissolved mineral matter and seldom contains undesirable ingredients. The same may be said, in general, for biotite gneiss and mica schist, although both these rock types may yield water of high iron content. On the other hand, the hornblendic rocks yield rather highly mineralized water in many places in the area. The amount of calcium and magnesium is usually great enough to make the water about as hard as that derived from limestone rocks. In places iron is present in undesirable quantities. Because the hornblendic rocks usually occur locally as sheets in older gneisses and schists, many wells intersect one or more sheets, thereby allowing ground water from different rock types to mix. This leads to considerable variation in the quality of water derived from hornblendic rocks.

Chemical Constituents in Solution[1]

Silica (SiO_2) is carried in solution by most ground waters. The type of silica-bearing minerals in the rock, the time of contact, and the composition of the water govern the extent to which silica is dissolved. Silica in water is troublesome in causing boiler scale and brittleness in high-pressure boiler plants, but otherwise is not objectionable for domestic or in-

[1]Adapted in part from Lamar, W. L., Industrial Quality of Public Water Supplies in Georgia: U. S. Geol. Survey Water-Supply Paper 912, pp. 7-15, 1940.

dustrial consumption. In ground water analyzed from the rocks of the Atlanta area the amount of silica in solution ranged between 11 and 45 parts per million.

Iron (Fe) is dissolved from practically all soils and rocks. Excessive hardness in water generally is regarded as the most undesirable feature, and excessive iron content is next. As most of the ground waters in the Atlanta area are not excessively hard, iron is regarded as the most undesirable constituent in water of the area. Its presence, even in relatively small amounts, makes desirable special treatment to remove it. Water that contains more than about 0.3 part per million gives trouble because of the appearance of reddish-brown sediment produced by oxidation of the iron, and because of staining of articles with which the water comes in contact. Iron can be removed by aeration, coagulation, and filtration. At College Park and East Point, for example, iron is removed in this way. Ground waters in the Atlanta area that were analyzed contained from 0 to 6.8 parts per million of iron; about a third of the samples contained 0.3 part or more.

Calcium (Ca) and magnesium (Mg) are dissolved from many rocks, but in the Atlanta area especially from hornblendic rocks and allied material containing the so-called ferromagnesium minerals. Most of the waters in the area carry 20 to 50 percent less magnesium than calcium. Both these elements, when present in appreciable quantities, make the water hard.

Sodium (Na) and potassium (K) are dissolved in small quantities from practically all rocks. When present in large quantities, they are usually derived from salts or brines associated with rocks of marine origin. Potassium is generally much less abundant than sodium. Moderate amounts of sodium and potassium have little or no effect on the utilization of well waters. Although the combined sodium and potassium content does not generally exceed 10 parts per million in the Atlanta area, an unusually large amount of sodium, for water derived from crystalline rocks, is present in some well waters, for example, in the vicinity of Sweetwater Creek near Austell, Cobb County. The cause for this condition in certain wells in the vicinity of Austell is not clearly understood, but a study of these waters is now in progress, and additional discussion is given in the description of Cobb County.

Carbonate (CO_3) and bicarbonate (HCO_3) in natural waters result from the action of carbon-dioxide-laden waters on the rocks, particularly limestone and dolomite. Carbonate-bearing hornblendic rocks in the Atlanta area yield waters relatively high in bicarbonate. However, waters containing bicarbonate in amounts exceeding 100 parts per million are rare everywhere in the area. The bicarbonate, as such, has little effect on the utilization of water. Carbonate (CO_3), which occurs only in relatively alkaline waters, is generally absent from the waters of the area.

Sulfate (SO_4) may be dissolved from rocks containing gypsum ($CaSO_4.2H_2O$), and may also result from the oxidation of sulfides. The crystalline rocks generally contain at least a small amount of one or more sulfide minerals, especially the unbiquitous pyrite (iron sulfide). Where considerable sulfate is present in hard water a hard boiler scale may be formed, and a modification of the method used for softening the water may be necessary.

Chloride (Cl) is dissolved in small quantities from rock materials. Chloride-bearing minerals are scarce in crystalline rocks and the amount of chloride in ground waters derived from such rocks is small. Chloride has little effect upon the utilization of water unless it is so concentrated as to impart a saline taste. Except for the small area noted above, in the vicinity of Austell, Georgia, the chloride content of well waters in this area is generally less than 15 parts per million.

Nitrate (NO_3) is generally considered to be a final oxidation product of nitrogen-bearing organic matter. Therefore, where present in appreciable quantities it may indicate previous contamination by sewage or other organic matter. The highest nitrogen content noted in any well in this area was 28 parts per million, from a well in the city of Marietta, Georgia.

Fluoride (F) is present in some waters, but usually in very small amounts. Only a few determinations of fluoride were made in ground water of the Atlanta area. Several wells, especially from the mineralized waters of the Austell area, Cobb County, yield water containing as much as 0.1 part per million. Fluoride in water is significant because of its effect on teeth. According to H. T. Dean,[1] United States Public Health Service, water containing 1.0 part per million or more of fluoride is likely to cause the dental defect known as mottled enamel, if such water is used by children during the period of calcification of the teeth. However, the effect at concentrations less than 1.5 parts per million is small, and the Public Health Service recommends that limit for waters used on interstate carriers. Small amounts of fluoride in water (below 1.0 part per million) are believed to inhibit tooth decay.

Total hardness, or soap-consuming capacity of water, is generally caused by the presence of calcium and magnesium in the water. Water having a hardness of less than about 50 parts per million (calculated as $CaCO_3$) is considered soft and is satisfactory for most domestic purposes. Water having a hardness between 50 and 150 parts per million is considered moderately hard, but is treated only for special uses. Water with a total hardness exceeding 150 parts per million is definitely hard, and special softening treatment is desirable where relatively soft water is needed. However, water having a hardness of 200 parts per million or more is used without treatment in many places. In the Atlanta area, the hardness of ground-water samples analyzed ranged from 18 to 1090 parts per million. In areas of hornblendic rocks the hardness may be high.

ROCK FORMATIONS AND THEIR WATER-BEARING PROPERTIES

Biotite Gneiss and Schist

GEOLOGY

The most widespread crystalline rocks in the Atlanta area are those of an immense series of interbedded biotite gneisses, mica schists, and thin granitoid layers. This series is strikingly similar to the Carolina gneiss of North and South Caro-

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[1]Dean, H. T., Chronic Endemic Dental Fluorosis: Am. Med. Assoc. Jour., vol. 107, pp. 1269-1272, 1936.

lina.[1] It is generally thought to be of pre-Cambrian age and comprises the oldest rocks in the area. The variations in lithology[2] result from differences in the original character of the sediments from which the schists were derived, although some variation may be attributed to the character of metamorphism and extent of injection.

The gneiss is most prominent south of the Chattahoochee River, but the series includes many schists and other rock types. The gneiss is composed of quartz, feldspar, and biotite with minor amounts of muscovite, garnet, and other accessory minerals. The texture ranges from fine- to coarse-grained, and the color from light gray to black.

Interbedded with the gneiss and forming several elongated belts is a mica schist, ranging in color from gray to green but producing red micaceous, sandy soils. The schist is well developed in Cobb County north of the Chattahoochee River. The preponderance of thin scales of muscovite mica gives the rock considerable fissility or schistosity. In addition to muscovite and quartz, the schist contains, in places, conspicuous amounts of garnet, sillimanite, and graphite.

Both the biotite gneiss and the mica schist have been intruded by granites of several types. In addition to the granite intrusives, hornblende gneiss, pyroxenite, and dolerite are intruded into the gneisses and schists. In places intrusive bodies of granite are so numerous that the resultant rock is composed of intercalated host rock and injector. The granite material was injected, for the most part, parallel to the schistose planes of the preexisting rocks, with the result that the granite and the allied pegmatites conform closely to the schistosity.

Where biotite gneiss and schist are near large granite masses, such as at Lithonia and Palmetto, the intrusive granitic material predominates, but at places more remote from the large granite masses the original gneiss and schist country rock prevails. The gradational zone, constituting fully half the area described in this report, represents an injection complex in which individual rock bodies are generally too small to map separately.

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[1]Keith, Arthur, U. S. Geol. Survey, Geol. Atlas, Cranberry folio (no. 10) p. 2, 1903.
[2]Crickmay, G. W., Unpublished report on the crystalline rocks of Georgia, p. 7, 1936. (In files of Georgia Geol. Survey.)

The intimate association between the country rock (biotite gneiss and schist) and the granitic intrusives is worth noting. For the most part, the injected rocks occur as distinct sheet-like masses in the host rock. Both the sheets and the inter-sheet zones range in thickness from a fraction of an inch to many feet. The relation between the host rock and the granitic intrusive, however, is so intimate in some parts of the area as to produce a rock that can be termed a biotite injection gneiss, which composes part of the injection complex here described. This is especially true, for example, in the area underlying metropolitan Atlanta, where much of the banded gneiss results from linear injection of granitic material into the preexisting country rock. Future detailed studies in this area will doubtless distinguish mappable units, which in this report have been considered as a single rock series.

WATER SUPPLY

The biotite gneiss and schist series or injection complex is a fairly good source of water supply. Crevices large enough to transmit some water are common along foliation planes in the gneiss, and where these planes intersect cross-joints the circulation and storage of ground water are increased. In the schist, parting planes along the schistosity are more numerous but are thinner and transmit water less readily than those of the gneiss.

Most wells drilled into the injection complex are productive because distinct parting planes along which ground water moves occur at the contacts between the granite and host rock. Fault zones, which occur in many places, afford additional storage for water. However, it is usually difficult, if not impossible, to trace the courses of the faults with accuracy sufficient to enable the driller to intersect them at practical depths.

Considerable variation exists in the chemical quality of water derived from the biotite gneiss and schist. For example, water derived from a well penetrating only biotite gneiss and granite would, in all probability, be low in dissolved solids and in hardness. Water from wells penetrating mica schist usually is low in dissolved solids but, in some instances, may contain appreciable amounts of iron. Where wells penetrate one or more sheets of hornblendic rock, the water may contain noticeable quantities of calcium, magnesium, or iron. It is evident that the amount and type of mineral matter present in the water vary with the type and thickness of the rock penetrated.

Brevard Schist

GEOLOGY

The Brevard schist was named by Keith[1] for exposures of dark-colored schists in the vicinity of Brevard, Transylvania County, North Carolina. This formation in Georgia has been described by Crickmay,[2] who identified it in a belt from Stephens and Habersham Counties across the State through Heard County into Alabama. It is noted for the straightness of its course. This belt of rocks, in which the Chattahoochee River is partially entrenched, is rarely over 2 miles in width and forms essentially the northwestern boundary of Fulton County.

Lithologically, the Brevard schist is predominantly a fine-grained gray to black quartz-mica schist. Lenses of quartzite occur locally, and bodies of marble and biotite gneiss have been observed in parts of this belt east of the Atlanta area.[3] The schist is graphitic in places, and there the rock may grade into limestone with depth. The rock is almost devoid of intrusives, although some quartz veins are present. The contact between the schist and adjacent rocks is rarely clear. Indeed, the apparent gradation between the adjacent rock and the schist and the fact that the schist is extremely sheared suggests that the belt does not represent a separate rock but merely a major, extensive shear zone. Thus the rocks within this belt may represent a crushed and compacted phase of the neighboring rocks.

WATER SUPPLY

The Brevard schist appears to be the poorest producer of ground water in the area. It is believed that this condition

[1]Keith, Arthur. U. S. Geol. Survey, Geol. Atlas, Mt. Mitchell folio (no. 124), p. 2, 1903.

[2]Crickmay, G. W., Unpublished report on the crystalline rocks of Georgia, p. 52, 1936. (In files of Georgia Geol. Survey.)

[3]Crickmay, G. W., op. cit., p. 52.

is due, in part, to the highly dissected topography of the country underlain by these rocks. The dissection has been brought about through the entrenchment of the Chattahoochee River and its tributaries. Rugged topography of this kind encourages rapid surface runoff, allowing relatively little influent seepage into the underlying bedrock. Also, it permits leakage of much of the ground water through springs which are rather numerous on the lower slopes. Finally, it appears that schists in general, although capable of absorbing ground water, yield such water only with difficulty because the numerous crevices are generally small. In this respect it is similar to a fine-grained sedimentary rock, which may contain much water but which does not yield it freely.

The quality of water from the Brevard schist normally is good, but iron in objectionable amounts may be present locally.

HORNBLENDIC ROCKS

GEOLOGY

Crystalline rocks of igneous origin containing conspicuous amounts of the dark mineral hornblende are common in the Atlanta area. Where the rock is foliated it is called hornblende gneiss. Its foliation generally conforms to that of the enclosing biotite gneiss and mica schist, in which it occurs as lenticular and sheetlike masses. These bodies seldom exceed a few feet in thickness. Because these rocks intrude the biotite gneiss and schist but are, in turn, intruded by granites, they are younger than the biotite gneiss and the schist but older than the rocks composing the granite group. The hornblendic rocks are commonly intermingled with the injection complex throughout the Atlanta area, but seldom in masses of sufficient size to be mapped (pl. 1.). The rock is composed chiefly of hornblende, with subordinate amounts of feldspar and quartz. It weathers rapidly, usually into a yellow-brown residual clay of high fertility.

The hornblende gneiss, as it occurs in western Cobb County, is coarse-grained and of varied composition. A somewhat massive feldspar-rich phase bordering the granites, in some places, suggests the possibility that when the granite was intruded its fluids permeated the hornblende gneiss and altered it to a hybrid rock approximating diorite. Near the junction of Clayton, DeKalb, and Fulton Counties, near Conley, a mass of hornblendic rocks underlies an area several miles in diameter. Locally these rocks are composed almost entirely of hornblende or of pyroxene made up of large blades arranged in radiating clusters. These rocks weather to a green chlorite. In places conspicuous amount of feldspar compose the main mass of the rock.

WATER SUPPLY

Compared to other rocks in the area, the hornblendic rocks yield relatively large quantities of ground water. Joints and fractures are numerous, and in places the bodies of this rock are sufficiently thin to be penetrated completely by wells. Openings along the planes of contact with adjacent rocks transmit additional water, an important factor contributing to the favorable water-bearing character of these rocks. The average yield from wells, chiefly industrial, that penetrate several sheets of these hornblendic rocks has been about 50 gallons per minute.

The water derived from rocks of this type contains a relatively large amount of mineral matter. Although rarely objectionably hard, the water in places contains relatively large amounts of calcium and magnesium. Of special interest here is the quality of the water from a group of wells near the town of Austell, in Cobb County. These wells, which are believed to penetrate hornblendic or allied rocks, yield waters high in sodium chloride. They are discussed in more detail later in this report, in the description of Cobb County.

Granites

GEOLOGY

Granites are granular crystalline rocks of igneous origin. They contain as their chief constituents quartz and members of the feldspar group. In addition to quartz and feldspar, most granites also contain minor amounts of accessory minerals often found in granite are muscovite, biotite, garnet, and hornblende. The granitic masses in Georgia range from stringers and dikes a few inches thick to batholiths which underlie areas 10 miles or more across. Pine Mountain and its granitic extension in DeKalb County form an example of a granite batholith.

The age of the granite rocks has not been positively determined nor is the relation of one granite body to another always clear. The massive granites showing little or no effect of deformation are thought to have been emplaced during, or following, the Appalachian deformation—that is to say, in late Paleozoic or early Mesozoic time. All the granites, however, are older than the diabase dikes, which intrude them and which are considered to be of Triassic age. It is possible that some of the granites in this area are of pre-Cambrian age.

At Stone Mountain a huge dome-shaped ridge rises more than 680 feet above the surrounding terrain. This dome is one of the best-known exposed granite masses of the world. The rock[1] composing it is an even-textured, medium-grained, light-gray, biotite-bearing muscovite granite, which shows little variation in color or composition. The stone is widely used for monuments, building stone, and aggregate.

In the vicinity of Lithonia, in DeKalb County, are several exposures and bosses of a contorted gneissic granite. The gneissic character of this granite is due to the segregation of biotite into bands alternating with those of light-colored quartz and feldspar. The banding is sinuous and is not necessarily aligned with the regional structure. A lack of parallel arrangement of the biotite crystals is apparent, and this property prevents splitting of the rock along the planes of lineation. The banding may be attributed to viscous flow in a heterogeneous magma at the time of emplacement and not to later deformation. The Lithonia-type granite is extensively used as aggregate and for building purposes.

A coarse-grained porphyritic granite is typically exposed near Palmetto in southern Fulton County. Feldspar crystals form the phenocrysts and are weathered out in some surface exposures.

WATER SUPPLY

The granites of the area generally yield appreciable quantities of ground water. In the larger granite masses vertical

[1]Watson, T. L., Granite and gneisses of Georgia: Georgia Geol. Survey Bull. 9, p. 114, 1902.

and diagonal joints are rare, and the rather flat-lying joints resulting from exfoliation, or sheeting, are the major openings through which ground water moves. These exfoliation planes usually conform to the topography, but are flatter (fig. 8). In valleys underlain by granite the exfoliation planes are concave upward and form receptacles for ground water moving down from adjacent upland slopes. Hence, wells situated in lowlands underlain by granite have an excellent chance of producing moderately high yields. All granites in the area exhibit distinct exfoliation. Indeed, Stone Mountain owes its bald surface to exfoliation and is therefore considered a classic example of the effect of this phenomenon.

Ground water from granites in the area contain very little mineral matter. Free silica and silicates of potassium, aluminum, and sodium, which compose the bulk of these rocks, are relatively insoluble in ground water.

ALLUVIUM

Sand and gravel deposits occur here and there on both sides of the Chattahoochee River and along the lower reaches of several of its tributaries. Along the Chattahoochee these deposits are not extensive, as the stretch along the river is in a youthful stage of erosion, so that the river is more active in removing than in depositing material along its course. The alluvium forms discontinuous deposits that are of unknown thickness and are generally less than a quarter of a mile wide. The best deposits occur in Douglas County on the north side of the Chattahoochee. Along the lower reaches of several of the larger tributaries, especially Nancy, Peachtree, Proctor, and Sweetwater Creeks, alluvial deposits are prominent.

Although data are lacking, such alluvial deposits are thought to constitute a potentially important source of ground water in the Atlanta area, especially where wells or galleries near perennial streams could depend on recharge by infiltration of river water. Thus far water in the alluvium has not been utilized, probably because of its location in lowland areas subject to periodic flooding.

COUNTY DESCRIPTIONS

Introduction

In the pages that follow the geography, geology, and ground-water conditions in the Atlanta area are described by counties in alphabetical order. Following each county description are tables containing data on wells in the county and analyses of water from some of the wells and springs.

The wells for which data were collected are numbered consecutively by counties. The number of each well in the tables corresponds with the well numbers in plate 2. These correspond also to the numbers used in the tables of chemical analysis and in the text of the report.

As very few of the wells have been given a thorough pumping test, the yields reported for many of them probably are not accurate. The yields given usually are based on short bailer tests or are estimates based on the performance of the wells in service.

Clayton County

Clayton County, according to the census of 1940, had a population of 11,655. The largest town is Jonesboro, the county seat, whose 1940 population was 1,204. Other towns within the county are Forest Park, Lovejoy, Conley, and Riverdale. The economy of the county is largely agricultural, but also important is the production of textiles, lumber, furniture, and concrete building blocks.

PHYSIOGRAPHY

Clayton County is, for the most part, an upland of moderate relief. The drainage consists of small streams—tributaries of the Flint River on the west and the Ocmulgee on the east. These two drainage systems are separated by a low, rounded surface ridge, which trends southeast and is followed by the Central of Georgia Railway from Atlanta through Jonesboro and Lovejoy to Macon, Georgia.

GEOLOGY

Biotite gneiss forms the dominant country rock of the county and is particularly well represented in the area south of

Jonesboro. Associated with the gneiss are only minor amounts of granitic intrusives, except in the northern part of the county where granite forms the country rock. The granite associated with the gneiss occurs as thin lenses generally conformable to the trend of the gneissic country rock. In the northern part of the county, in a broad area surrounding Forest Park, a large discordant granite mass exists. This large granite body probably represents the parent material from which the granitic offshoots and lenses in the surrounding country rock were derived. In the extreme northern part of the county—the Conley area—pyroxenite or hornblendic rocks form the country rock. Granite intruding this large body of pyroxenite has been assimilated in part by the pyroxenite to form a feldspar-rich pyroxene or hornblende rock. Assimilation of granite by the various older rocks, is not common, however, most contacts being sharp and distinct.

GROUND WATER

Much of the water supply of the county is derived from individually owned shallow dug wells. Most of the drilled wells in the county are used for the larger homes and for municipal supplies. Surface water has not yet been utilized to any great extent in the county, except at Conley and Forest Park where water is furnished by the city of Atlanta.

The biotite gneiss in the county is a moderately good producer of ground water. It is extensively exposed in the southern section of the county. Many wells drilled in the large granite area in the northern part of the county have not been successful. These unsuccessful wells have been located almost invariably on upland slopes where the exfoliation planes are convex downward. Water in exfoliation openings moves down them into the exfoliation openings that are concave upward in the valleys. Therefore, it is likely that most wells drilled in lowland areas underlain by these granites will be successful. In the Conley area ample water supplies are generally obtained from wells penetrating the hornblendic rocks.

Jonesboro (population 1,204).—In 1943 two drilled wells furnished the municipal water supply of Jonesboro. The well near the courthouse is 306 feet deep and reportedly yielded 21 gallons per minute with the pump set at 270 feet. The other well then in use, on the west side of town, is said to be 300 feet deep and reportedly yielded 52 gallons per minute. Both these wells penetrate strata of the biotite gneiss and schist series and, judging from the fact that more than 150 feet of casing was used in both wells, it would seem likely that the weathered zone extends to approximately that depth. Three additional wells, of which no records are available, have been drilled in this area but have subsequently been abandoned. In the summer of 1947 it was understood that some consideration was being given to a future surface supply because of the possible inadequacy of the wells then in use. Chemical analysis of water from one well furnishing water to the municipal system showed that it was high in iron and was also moderately hard. The water from the city wells is pumped directly into the city mains without treatment.

Forest Park (population 577).—Prior to 1943 the municipal supply of Forest Park was obtained from one deep well. During 1943 several attempts were made to increase this supply by drilling additional wells, none of which were successful. The need for additional water became more acute, and to relieve this condition supplemental supplies were eventually obtained from the city of Atlanta. At the present time surface water from Atlanta and water from the one deep well constitute the municipal supply of Forest Park. The well water is treated for removal of carbon dioxide and is chlorinated. All wells in this area, including the unsuccessful wells, penetrated poorly jointed granite, which is extensively exposed in this part of Clayton County. Failure to obtain successful wells is believed to be due to topographic and geologic conditions, which together add up to make Forest Park a poor location. The town is on a granite ridge, where parting planes, chiefly due to exfoliation, are convex downward, thereby permitting ground water to drain to the lowlands. Numerous springs on either side of this ridge form evidence of such leakage.

RECORDS OF WELLS IN CLAYTON COUNTY

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
1	Opposite SE corner of Court House, in Jonesboro.	Town of Jonesboro	Kennedy	Drilled	305	6	Granite		21	Hilltop. Analysis.
2	W. side of town, near small creek, in Jonesboro.	do.	Hamilton & Sullivan.	do.	300	6	do.	8	52	Lowland slope.
3	Few hundred yds. SW. of Central Ga. R. R. Sta., in Forest Park.	Town of Forest Park.	Georgia Well Drilling Co.	do.	222	8	do.	15	20	Upland ridge.
4	N. side of town, near small creek, in Forest Park.	do.	Economy Well Drilling Co.	do.	331		do.		10	Near top of upland ridge Abandoned.
5	E. side Hwy. 41, just S. of bridge over Central Ga. R. R., in Forest Park.	Wofford Investment Co.	do.	do.	293	10	do.	21	20	Upland ridge.
6	1.5 mi. S. of Forest Park, midway between Hwy. 41 and 54.	V. H. Shelnutt	do.	do.	167	6	do.	20	8	Rolling upland.
7	W. side Hwy. 41, ½ mi. S. of bridge over Central Ga. R. R., in Forest Park.	H. P. Lieupo (formerly J. R. Dubberly).	do.	do.	188	8	do.	21.9	10	Upland ridge.
8	W. side Hwy. 41, 0.6 mi. S. of bridge over Central Ga. R. R., in Forest Park.	W. A. Bobo	do.	do.	502	6	do.		1	Upland ridge Abandoned.
9	½ mi. SW. of Hwy. 41, in Forest Park.	H. D. Thames	do.	do.	176	8	do.	15.6	43	Temp. 62° F. Abandoned.
10	On Hwy. 41, 1 mi. N. of Lovejoy.	Hastings Seed Co.		do.	150	6	do.		15	Rolling upland.
11	E. Side Hwy. 41, 0.3 mi. S. of Clayton-Fulton Co. line.	Pete Kacoonis	O. V. Helms	do.	320	6		45.5	3.5	Top of upland ridge Abandoned.
12	do.	do.	do.	do.	131	6	Injection complex	60	4	Near top of upland Abandoned.
13	E. side Hwy. 41, in Hapeville	S. E. Davidson	Dug	do.	63.5	36	do.	57.3		Hilltop.

RECORDS OF WELLS IN CLAYTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
14	0.6 mi. E. of Hwy. 41, in Mountain View.	J. E. Dawson	Economy Well Drilling Co.	Drilled	110	6	Injection complex	59.5		do.
15	Adjoins property of well 14, in Mountain View.	W. M. Lyle		Dug	67.5	36	do.	60		do.
16	W. side Hwy. 54, at ice plant, in Forest Park.	J. E. Wells		Drilled	180	6	do.		25	Hilltop.
17	W. side Hwy. 54, 0.9 mi. S. of Central Ga. R. R. Sta., in Morrow.	Aristocrat Dairy	Economy Well Drilling Co.	Drilled	155	6	Granite	50	25	Hilltop.
18	do.	do.	do.	do.	503	6	do.	42.3	3	Abandoned.
19	do.	do.	do.	do.	161	6	do.	50	16	Hilltop.
20	do.	do.	do.	do.	161	6	do.	50	10	do.
21	E. side Hwy. 41, ¾ mi. S. of of bridge over Central Ga. R. R., in Forest Park.	W. J. Hunter	O. V. Helms	do.	198	6	do.	40	10	Upland ridge.
22	E. side Hwy. 41, ¾ mi. S. of bridge over Central Ga. R. R., in Forest Park.	H. P. Lieupo	Economy Well Drilling Co.	do.	217	6	do.	30	20	Upland slope.
23	W. side Hwy. 41, ¾ mi. S. of bridge over Central Ga. R. R., in Forest Park.	J. C. Hulgan	do.	do.	80	5	do.	20	6	Upland ridge.
24	Adjoins property of well 23	W. H. Bell	do.	do.	111	6	do.		40	do.
25	E. side Hwy. 41, 1 mi. S. of bridge over Central Ga. R. R.	J. W. Chapman	do.	do.	400	6	do.	35	3	do.
26	E. side Hwy. 41, 3 mi. S. of Clayton-Fulton Co. line.	A. C. Crane	do.	do.	165	6	do.	16		Hilltop Abandoned.
27	E. side Hwy. 41, 4 mi. S. of Clayton-Fulton Co. line.	G. T. Humphrey (formerly J. L. Paul).	do.	do.	200	6	do.	30.3	10	Upland ridge.

RECORDS OF WELLS IN CLAYTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
28	N. side of E-W dirt rd., 0.3 mi. W. of Hwy. 41.	Roscoe Carden	Economy Well Drilling Co.	Drilled	80	6		25	50	Upland slope.
29	N. side Riverdale Rd., at junction of Riverdale Rd. & Hwy. 41.	W. Langhauser	do.	do.	210	6	Injection complex	30	4	Upland ridge.
30	N. side Riverdale Rd. 1.8 mi. NW. of junction of Riverdale Rd. & Hwy. 41.	N. H. Bebefield		Dug	23.8	36	do.	16.3		Hilltop.
31	N. side Riverdale Rd., 0. mi. E. of Southern R. R. in Riverdale.	Clayton Co. (Riverdale School)	do.	Drilled	195	6	do.	28	22	Upland ridge.
32	E. side Hwy. 41, 0.4 mi. S. of junction Hwy. 41 & Riverdale Rd.	Mrs. H. L. Cobb		do.	300		do.		15	do.
33	E. side Hwy. 41, 0.9 mi. S. of junction of Hwy. 41 & Riverdale Rd.	W. A. Springsteen	do.	do.	155.5		Granite		30	do.
34	½ mi. N. of Central Ga. R. R., in Forest Park, E. side small creek.	Town of Forest Park.	do.	do.	250	6	do.		0.5	Near top of upland ridge.
35	0.1 mi. E. Hwy. 54, ½ mi. N. of Central Ga. R. R. underpass, in Forest Park	R. C. Pair	do.	do.	280		do.	44.1	6	Hilltop.
36	E. side Hwy. 42, about 0.2 mi. N. of main entrance to U. S. Army Depot at Conley.	V. B. Blalock & H. G. Moore.		do.	250	6	Pyroxenite		30	Upland slope.
37	W. side Hwy. 42, 0.1 mi. S. of Clayton-DeKalb Co. line, in Conley.	H. C. Moore	Economy Well Drilling Co.	do.	125	6	do.	40	10	Hilltop.
38	W. side Hwy. 42, 0.6 mi. S. of Clayton-DeKalb Co. line, in Conley.	D. E. Holmes	do.	do.	139	6	do.	60	10	Top of high hill.

RECORDS OF WELLS IN CLAYTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
39	On Hwy. 41, 1 mi. N. of Lovejoy.	Hastings Seed Co.		Dug	31.1	36	Pyroxenite	22.0	5	Upland plain.
40	do.	Clayton Co. (Lovejoy Schools)		Drilled	268	6	do.		10	do.
41	Opposite SW. corner of furniture factory, at Rex, Ga.	Estes Mfg. Co.	Economy Well Drilling Co.	Drilled	425	5	Injection complex	4.2	2	Lowland slope Abandoned.
42	N. of furniture factory, opposite NW. corner private dwelling, at Rex, Ga.	do.	do.	do.	225	6	do.	18.1	2	Hilltop Abandoned.
43	N. side Hwy. 0.2 mi. W. of Hwy. bridge at Rex, Ga.	do.	B. H. Ragan	do.	290	6	do.		1	Top of high hill.
44	About 0.4 mi. S. of Central Ga. R. R. Sta., near municipal baseball park, in Forest Park.	Town of Forest Park.	do.	do.	250	6	Granite		2	Near top of upland ridge. Abandoned.

RECORDS OF SPRINGS IN CLAYTON COUNTY

Location	Owner	Name	Source rock	Yield (gallons per minute)	Remarks
A 2 miles north of Lovejoy on west side of Hwy. 41.	Hastings Seed Company		Granite	25	Analysis.
B Near Swamp Creek, 2 miles southwest of Jonesboro.	Mundys Mill Spring		do.	4½	

ANALYSES OF WATER FROM CLAYTON COUNTY

(Parts per million. Numbers at heads of columns correspond to numbers in tables of wells and spring data. Analyses by Edgar Everhart and L. H. Turner, in Georgia Geological Survey Laboratory.)

Number	1	A
Source rock	Granite	Granite
Silica (SiO_2)	22	6
Iron (Fe)	4.9	0.05
Calcium (Ca)	29	Trace
Magnesium (Mg)	.7	Trace
Sodium (Na)	6.8	0
Potassium (K)	.65	0
Bicarbonate (HCO_3)	..	10
Sulfate (SO_4)	15	0
Chloride (Cl)	16	3
Nitrate (NO_3)	..	0
Total dissolved solids	..	38
Total hardness as $CaCO_3$	..	17
Fluoride (F)	..	0
Date of collection	Sept. 24, 1921	Jan. 22, 1938
Analyst	Everhart	Turner

Cobb County

In 1940 Cobb County had a total population of 38,272, more than a fourth of which is in the city of Marietta, which is the county seat and is in the northeastern part of the county. Other centers of population are Acworth, Austell, Kennesaw, Powder Springs, and Smyrna. Cobb County, which forms the northwestern part of the Atlanta area as here described, is bordered on the south and east by the Chattahoochee River which, for the most part, separates it from Fulton County. The chief activities in the county are agricultural—the cultivation of corn, wheat, and cotton, and the raising of cattle. Gold and mica are mined sporadically, but the production has never been large. Other activities important to the economy of Cobb County include the production of textiles, lumber, and monumental stone, particularly granite and marble.

PHYSIOGRAPHY

The upland plain on which the city of Atlanta is situated extends northward into Cobb County, although it has been deeply incised by the Chattahoochee River. Sweat and Kennesaw Mountains are conspicuous hills rising above the surface of the upland in the northern part of Cobb county. Most of the streams north of Marietta flow northwest as part of the Etowah River system, and streams rising south of that city flow southeast through short courses to join the Chattahoochee River.

GEOLOGY

The biotite gneiss and schist series constitutes the predominant rock type of Cobb County, forming a wide belt southeast of Marietta extending almost to the Fulton County line. However, this rock of the series is, for the most part, distinctly more schistose than that in the other counties of the area. The regional dip is southeastward, and the thin linear bodies of enclosed granite and hornblende gneiss conform to the regional structure.

In the general area north and west of Marietta both hornblendic and granitic rocks have, to a great extent, invaded and replaced the biotite gneiss and schist host rock. The hornblendic rocks have a coarse- to medium-grained texture and a composition that varies, hornblende predominating in some places and feldspar in others. Granite has intruded the country rock extensively. Contacts of the granite with hornblendic rocks are, in many places, transitional, and this transitional or hybrid rock is classified as a diorite gneiss. The diorite gneiss is present in the extreme northwest portion of the county west of Acworth and as a zone enveloping the granite core of Kennesaw Mountain.

The Brevard schist, as mapped, forms a narrow belt along the Chattahoochee River. This is a very schistose rock, almost devoid of intrusive material. The schist is similar to the mica schist of the biotite gneiss and schist series, which borders it on the northwest.

GROUND WATER

The part of Cobb County southeast of an extended line passing through Austell and Marietta is an area of relatively poor ground-water conditions. The rocks occupying this section consist mostly of schists which dip steeply to the southeast. Although parting planes along the schistosity are numerous, the crevices are so tight as to prevent ready circulation of ground water through them. In addition, the topography in this area is distinctly hilly, especially in the immediate vicinity of the Chattahoochee River. Such a condition, as previously indicated, promotes increased surface runoff, decreases influent seepage, and causes leakage of the ground water recharged at the higher elevations. The remaining, or northwestern, part of the county represents an area in which moderate amounts of ground water are available. In this part of the county are rocks of many different types, generally in rather small bodies, so that numerous contact planes occur which are accessible to circulating ground water, increasing the amount of water available to deep wells that penetrate the rocks. In addition, water-laden joints are numerous in the granite and hornblende gneiss, rock types common in this part of the county.

Some of the ground waters of Cobb County, especially in the vicinity of Austell, Powder Springs, and Acworth, are strikingly high in certain mineral constituents, particularly in sodium chloride. McCallie[1] has described, in some detail, waters from several wells in the vicinity of Austell. Since that time, 40 years ago, new analyses of these waters have been made. Recent analyses differ but slightly from the earlier records. In addition to chloride, these well waters show heavy concentrations of other mineral constituents. In two of the wells the dissolved solids are in excess of 6,000 parts per million. The quality of these waters is especially baffling in view of the fact that granite, which is almost insoluble, forms the only discernible rock in the vicinity of these wells. It is possible that a highly soluble basic rock, so far not observed, exists and is responsible for the mineral content of these waters. A more intensive study of the waters is planned and it is hoped that such work will solve this perplexing problem.

Marietta (population 8,667).—Altogether, more than 30 deep wells have been used over a period of years for the municipal water supply of Marietta. As of June 17, 1947, 13 of 17 wells in operative condition yielded 390,000 gallons per day. The water is pumped into the city mains without treatment of any kind. The average well is 400 feet in depth and 10 inches in diameter, and the average pumping level is 200 feet beneath the surface. As of June 1947, the ground water was being supplemented by approximately 1,000,000 gallons per day of treated surface water from the city of Atlanta.

Several unsuccessful wells have been drilled on the southeast side of town, where a belt of steeply dipping mica schist underlies the part of the city southeast of the Marietta National Cemetery. This belt, which as stated previously is a relatively poor ground-water area, extends southeast to the Chattahoochee River. The average expected yield of a well in this schist belt is slightly less than 15 gallons per minute.

In the vicinity of the National Cemetery is the southeast edge of a northeast-trending belt of hornblendic rocks containing lenses of granite and mica schist essentially parallel with the foliation. The main part of the city is in this belt. Jointing, both across the foliation and parallel with it, and

[1]McCallie, S. W., Underground waters of Georgia: Georgia Geol. Survey Bull. 15, pp. 203-205, 1908.

contact planes are common and give access to ground water. Practically all productive wells of the city are drilled in this rock, the wells yielding an average of 25 gallons per minute.

The hornblende gneiss predominating in the northwest part of the city yields water rather high in mineral matter. Well 166, on Campbell Street, drilled into hornblende gneiss, yields water having 226 parts per million of dissolved solids and a hardness of 121 parts per million. Other well waters in the immediate area contain more or less mineral matter, depending upon the proportion of hornblendic rocks encountered by the wells. A nearby well on Sessions Street, No. 165, reportedly passing through only a thin lens of hornblende gneiss, contains only 59 parts per million of dissolved solids. No analyses are available for wells deriving water from the mica schist belt in the southeast part of the city, although reports indicate such water to be soft and iron bearing. The high nitrate content in waters of wells 58, 64, 65, and 66 strongly suggests contamination by organic matter, although this is not altogether certain. The fact that the wells are widely spaced and in relatively soluble hornblendic rocks, as are the few other wells in the area yielding water high in nitrate, may indicate a mineral rather than an organic origin for the nitrate.

Acworth (population 1,250).—The municipal water supply of Acworth is derived from seven 8-inch wells which range in depth from 315 to 550 feet, and which have average yields of approximately 35 gallons per minute. Water from these wells is pumped into the city mains without prior treatment. The rock penetrated by these wells is, for the most part, a diorite injection gneiss in which the intruded granite has been partially absorbed by the host rock, the hornblende gneiss. Analysis of water from a well (No. 90) drilled in 1946 to an approximate depth of 500 feet showed an unusually large amount of dissolved solids. The water contained 69 parts per million of chloride and had a total hardness of 253 parts per million.

Austell (population 1,229).—The town of Austell derives its water supply from Sweetwater Creek. Water from the creek is treated by the addition of alum and lime, and is then settled, filtered, and chlorinated. A final pH adjustment is made with lime before distribution to the various users.

Clarkdale, a mill center a few miles northwest of Austell, also obtains water from Sweetwater Creek, and the water receives similar treatment.

Smyrna (population 1,440).—The history of the municipal water supply for the town of Smyrna has been that of most growing towns in the Atlanta area. Formerly, for reasons of economy and ready accessibility, Smyrna derived its municipal supply from deep wells drilled over a period of years. Owing to a steadily increasing demand and an accompanying lack of adequate ground-water reserves, this municipality, in April 1947, decided to abandon its wells altogether. Since that time Smyrna has purchased treated surface water from the city of Atlanta.

The geologic conditions as related to the occurrence of ground water in the Smyrna area are of special significance. Smyrna is on a northwesterly trending upland ridge underlain by southeasterly dipping beds composed chiefly of mica schist. Owing to the steep slope of the western side of the ridge, and the resulting limited intake area there, wells drilled on the west side of town have been uniformly poor, if not complete failures. The only productive wells are, without exception, in the eastern part of town. The average yield of producing wells in Smyrna is about 15 gallons per minute. The iron content of many of these well waters is reportedly high.

Powder Springs (population 431).—Prior to 1935 Powder Springs obtained its municipal water supply from a spring. Because of periodic, probably seasonal, contamination from surface sources, this spring was abandoned and a deep well was drilled in 1935 near the center of town. Untreated water is pumped from the well to an elevated steel tank, from which it is distributed by gravity to the users.

In the Powder Springs area the country rock is predominantly hornblendic, but locally it is intruded by granite. Analyses of the spring and well waters indicate considerable mineralization, which is not surprising in view of the nature of the country rock there.

Kennesaw (population 436).—The town of Kennesaw has no municipal water supply, all water being derived from privately owned dug wells.

RECORDS OF WELLS IN COBB COUNTY

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
1	Midway between Hwy. 41 & Spring St., in Smyrna	Town of Smyrna		Drilled	380	8	Mica schist		12	Stream valley. Temp. 61° F. 4 p.p.m. Fe reported.
2	E. side Elizabeth St., in Smyrna.	do.	Ga. Well Drilling Co.	do.	175	10	do.	27.8	12	Abandoned.
3	A few feet S. of well No. 2 in Smyrna.	do.	do.	do.	175	8	do.		11	Water reported high in Fe. Temp. 62° F.
4	E. side New Roswell Rd., in Smyrna.	do.	do.	do.	350	8	Injection complex		12	Temp. 62° F.
5	W. side Whitfield St., in Smyrna.	do.		do.	138	8	Mica schist	10.8	8	Steep slope. Reported 12 p.p.m. of Fe. Originally yielded 35 gpm.
6	At junction of Highland, Old Roswell, and New Roswell Rds., in Smyrna.	do.	Ga. Well Drilling Co.	do.	175	8	do.	17.7	12	3 p.p.m. Fe. Temp. 6[illegible]° F. Abandoned.
7	N. side Spring St., between Roswell Rd. and N. C. & St. L. R. R., in Smyrna.	do.	do.	do.	680	8	do.		4	Abandoned.
8	N. side Church St., few hundred yds. W. of Public school in Smyrna.	do.	do.	do.	350	8	do.	69.59	6	do.
9	W. side Hwy. 41, in Oakdale, Ga.	Cobb Co. (Fitzhugh Lee School).	O. V. Helms	do.	205		Injection complex		25	Hilltop.
10	S. side Hwy. 78, 0.4 mi. E. of R. R. Sta. in Mableton.	The Candlelight Restaurant.	B. H. Ragan	do.	280	6	Mica schist		4	do.
11	0.8 mi. NW. of Ga. P. Co. underpass, E. side Log Cabin Dr., in Oakdale.	Mrs. J. H. Carmichael.	O. V. Helms	do.	60	6	do.	24.1		Upland slope.
12	W. side Hwy. 41, 0.2 mi. S. junction of Hwy. 41 & Log Cabin Dr., in Oakdale.	E. T. Banks	do.	do.	80.5		Granite gneiss		4	Abandoned.

RECORDS OF WELLS IN COBB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
13	W. side Hwy. 41, 0.5 mi. S. of Smyrna city limits.	Greatwood Dairy	O. V. Helms	Drilled	130	8	Hornblende gneiss	40	40	Upland ridge. do.
14	W. side Hwy. 41, 0.7 mi. S. of Smyrna city limits.	Rust Cheese Co.	do.	do.	117	6	Injection complex	38.3	50	Used in processing dairy products.
15	E. side Hwy. 41, approx. 1½ mi. NW. Marietta city limits.	Cobb County (Elizabeth School).		do.	382		Hornblende gneiss		22	Analysis.
16	E. side Hwy. 41, 0.7 mi. S. of Smyrna city limits.	F. L. McMillan	O. V. Helms	do.	113.5	6	Injection complex	42	3	
17	N. side Spring St., in Smyrna.	Town of Smyrna	Va. Supply & Well Co.	do.	280	8	Biotite gneiss		9	
18	About 100 yds. E. Hwy. 41, 0.3 mi. NW. of Smyrna city limits.	Mrs. F. W. Elridge		do.	70		do.	30	6	
19	About 100 yds. E. Hwy. 41, 0.4 mi. NW. Smyrna city limits.	M. H. Owin		do.	144		Injection complex	39	44	Upland slope.
20	W. side Hwy. 41, 0.7 mi. NW. of Smyrna city limits.	T. P. Dobbs	Helms	do.	105	6	do.	41.3		do.
21	E. side Hwy. 41, 0.45 mi. N. of Hwy. overpass over N. C. & St. L. R. R., in Oakdale.	J. B. Gaines (formerly Dr. Lewis Ray)	Tom Selders	do.	85	6	do.	33.8		
22	W. side Hwy. 41, 0.2 mi. S. of Smyrna city limits.	J. N. & A. F. Brawner	Hurt	do.	112		Mica schist	30	3	Upland slope.
23	E. side Log Cabin Dr., at Craven Wood Sta., in Oakdale.	O. B. Logan	Helms	do.		6	Biotite gneiss	20.7	6	do.
24	E. side Log Cabin Dr.; adjoins property of well 23, in Oakdale.	E. P. Logan	do.	do.	56	8	do.	14.5	12	Hilltop.

RECORDS OF WELLS IN COBB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
25	E. side Log Cabin Dr.; adjoins property of well 24, Oakdale.	J. T. Cox	Helms	Drilled	70.5	6	do.	14.8	5.5	Upland slope.
26	E. side Log Cabin Dr., few hundred yds. S. of Log Cabin Sta., in Oakdale	H. H. Hamby	J. L. Helms	do.	64	6	do.	20	6	Lowland slope.
27	E. side Log Cabin Dr., just S. of Log Cabin Sta., in Oakdale.	R. D. Webb		do.	54	6	do.	20.6		Steep slope.
28	E. side Log Cabin Dr., just N. of Log Cabin Sta., in Oakdale.	J. L. Priest	J. L. Helms	do.	90	6	do.	20	20	Hilltop.
29	W. side Hwy. 41, about 2 mi. S. of Smyrna city limits.	J. M. Bird	B. H. Ragan	do.	117	6	Injection complex	35	18.	Upland slope.
30	W. side Oakdale Rd., 0.6 mi. NE. of Hwy. 78.	R. W. Turner	J. L. Helms	do.	113.5	6	Granite gneiss	60	4	Hilltop.
31	W. side Oakdale Rd., 0.7 mi. NE., of Hwy. 78.	Mrs. F. C. Arnold	do.	do.	45	6	do.	25.8		Upland slope.
32	E. side Oakdale Rd., 0.5 mi. NE. of Hwy. 78.	H. B. Buckner	O. V. Helms	do.	78	6	do.	43.8		
33	W. side Oakdale Rd., 0.1 mi. NE. of Hwy. 78.	H. B. Buckner	O. V. Helms	do.	112		do.	40	4	Hilltop.
34	W. side of Oakdale Rd., 0.3 mi. NE. of Hwy. 78.	A. W. Richmond	A. W. Richmond	Dug	32.5		do.	28.2		Top of ridge.
35	W. side Oakdale Rd., at junction Oakdale Rd. and Hwy. 78.	I. P. Hannifin	O. V. Helms	Drilled	75.5	6	do.	19	4	Hilltop. Hard rock at 6 ft.
36	S. side Hwy. 78, about 0.5 mi. W. of Hwy. bridge over Chatt. river.	E. W. Brutton	J. L. Helms	do.	125	6	do.	22.9	25	Hilltop.
37	do.	do.		Dug	60		do.	42.5		

RECORDS OF WELLS IN COBB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
38	W. side Oakdale Rd., 0.2 mi. N. of Southern R. R. crossing.	C. L. Laird	O. V. Helms	Drilled	90.8		Granite gneiss		1	Top of high hill.
39	3 mi. SW. of Marietta.	Cobb County (prison)	Va. Supply & Well Co.	do.	295	8	Injection complex	30	12	
40	N. side Hwy. 78, about 0.4 mi. W. of Hwy. bridge over Chatt. River.	Mrs. Myrtle Cole		Dug	40		Granite gneiss	30		Upland slope.
41	About 3 mi. NE. of Powder Springs.	J. N. McEachern	Va. Supply & Well Co.	Drilled	250	8	Injection complex	32	24	
42	W. side Oakdale Rd., 1.2 mi. NE. of Hwy. 78.	J. A. West, Jr.	O. V. Helms	do.	105	6	Granite gneiss	24.1		Top of ridge. Well not in use.
43	N. side of Page St., in Marietta.	City of Marietta		do.	382	10	Injection complex		21	Upland slope.
44	E. side Oakdale Rd., 1.2 mi. NE. of Hwy. 78.	Mrs. J. A. West	O. V. Helms	do.	84	6	Granite gneiss	38.6		Top of steep hill.
45	W. side Oakdale Rd., 0.2 mi. S. of Southern R. R. Crossing.	O. V. Helms	do.	do.	90	6	do.	22		do.
46	W. side Oakdale Rd., 0.3 mi. S. of Southern R. R. Crossing.	do.	do.	do.	49	6	do.	20.9		Steep upland slope.
47	W. side Oakdale Rd., 0.2 mi. S. of Southern R. R. crossing.	do.	do.	do.	49	6	do.	22.9		do.
48	E. side Oakdale Rd., 0.1 mi. S. of Southern R. R. Crossing.	J. J. Watkins	J. L. Helms	do.	74	5½	Biotite gneiss	33.4		Hilltop.
49	W. side Oakdale Rd., 0.1 mi. S. of Southern R. R. Crossing.	O. V. Helms	O. V. Helms	do.	64	6	Granite gneiss		2	Steep upland slope.

RECORDS OF WELLS IN COBB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
50	0.5 mi. W. of Hwy. 3-E, about 2 mi. SE. of Marietta city limits.	Cobb County (airport)	Va. Supply & Well Co.	Drilled	235	8	Injection complex		75	Casing to 80 ft.
51	S. side Hwy. 5, 1½ mi. E. of Hwy. 3-E, NE. of Marietta.	T. O. Jarvis	do.	do.	118	6	do.	20	21	Drawdown 94 ft.
52	W. side of Oakdale Rd., 0.1 mi. N. of Southern R. R. Crossing.	C. C. Johnson	O. V. Helms	do.	43.5	5.5	Granite gneiss	14.3		Hilltop.
53	E. side Oakdale Rd. ½ mi. N. of Southern R. R. Crossing.	E. H. Dobbins		Dug	39		do.	5.5		Hilltop.
54	E. side Hwy. 3-E, about 1.7 mi. SE. of Marietta city limits.	R. R. Hawkins	Va. Supply & Well Co.	Drilled	350	8	Hornblende gneiss		30	Upland slope.
55	E. side Oakdale Rd., 0.4 mi. S. of Southern R. R. Crossing.	T. A. Herren		Dug	426		Injection complex	26		Hilltop.
56	N. side of E-W dirt Rd., 1.3 mi. E. Hwy. 41, about 2 mi. SE. of Kennesaw city limits.	Elwyn Tomlinson	Va. Supply & Well Co.	Drilled	300	6	Granite gneiss	45	31	
57	S. side of dirt Rd., 0.3 mi. E. of Oakdale Rd., about 1 mi. S. Oakdale corp. limits	Jim Lawson	O. V. Helms	do.	148	6	do.	20	4	Upland slope.
58	W. side of Wright St. extended, in Marietta.	City of Marietta		do.	297	10	Injection complex		34	Analysis.
59	Midway between Lemon St. and Hwy. 120, about 0.2 mi. W. of Marietta city limits.	do.		do.	506	8	Mica schist		30	Moderate slope.

RECORDS OF WELLS IN COBB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
60	About 0.6 mi. W. of Hwy. 41, near Chatt. R., at Ga. Power Co.; Plant Atkinson	Ga. Power Co.		Drilled	507	6	Sheared granite			Moderate slope. Yield unknown, but is probably 25 G. P. M.
61	do.	do.			475	8	do.			Moderate slope.
62	do.	do.			650	8	do.			do.
63	W. side Log Cabin Dr., 0.6 mi. N. of underpass of Ga. Power Co. Electric R. R.	A. W. Ray	Tom Selders	Drilled	200	6	Granite gneiss	38.3		Upland slope.
64	N. side Reynolds St., at junction of Reynolds and Wright Sts., in Marietta.	City of Marietta		do.	413	10	Injection complex		15	Analyses.
65	N. side of Sessions St., in Marietta.	do.		do.	272	10	do.		22	do.
66	N. side Sessions St., just W. of junction of Sessions and Campbell Sts., in Marietta	do.		do.	910	10	do.		22	Upland slope. Analysis.
67	W. side of Highland Ave. and N. of Whitlock Ave., in Marietta.	do.		do.	330	8	Biotite gneiss Hornblende gneiss		35	Gentle slope.
68	N. side Maple Ave., NW. part of city, in Marietta.	do.	Va. Supply & Well Co.	do.	400	8	Injection complex		16	Hilltop.
69	S. side Lawrence St., just E. of Sheppard St., in Marietta.	do.		do.	500	8	Mica schist		16	Moderate slope. Analysis.
70	S. side Sessions St., just E. of Rose Lane in Marietta.	do.		do.	506	8	Injection complex		40	Moderate slope.
71	S. side of E-W. dirt rd., 0.2 mi. E. of Camp Highland Rd.. in Oakdale.	Mrs. Lillian Mavell	Cooke & Fowler	do.	109	6	Biotite gneiss	55	5	Upland slope. Water reported high in Fe.

RECORDS OF WELLS IN COBB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
72	Adjoining property W. of well 71.	A. H. Coleman		Dug	68.4		Biotite gneiss	66.6		Upland slope.
73	E. side Camphighland Rd. about 1½ mi. SW. of Oakdale, at YWCA Camp.	Atlanta Y. W. C. A.	Ga. Well Drilling Co.	Drilled	97		do.		8	Hilltop.
74	E. side Hwy. 3-E, about 1.0 mi. E. of Marietta city limits.	A. P. Hogan		do.	96	7	Mica schist	46.5		do.
75	S. side Hwy. 41, near Hwy. bridge over N. C. & St. L. R. R., about 1 mi. N. of Marietta city limits.	Spicer Lumber Co.		do.	450	10	Hornblende gneiss	20.64	100	
76	Few hundred yds. E. of N. C. & St. L. R. R., near steel water tank, in Acworth.	Town of Acworth	Hamilton & Sullivan	do.	315	8	Diorite-granite	70	40	
77	About ¼ mi. E., of N. C. & St. L. R. R., top "Mitchell Hill", in Acworth.	do.	do.	do.	410	8	do.	70	30	Slight interference with well 76, a few hundred feet away.
78	About ¾ mi. E. of N. C. & St. L. R. R., near top "Mitchell Hill", in Acworth.	do.	W. A. Canady	do.	350	6	do.	70	45	Top of high hill, 70 ft. from well 77. Affected by pumping of well 77.
79	Few yards W. of Acworth Public School, in Acworth.	do.	Ga. Well Drilling Co.	do.	500	8	do.	70	22	Near top of hill. Temp. 62° F. Analysis.
80	E. side Cherokee St., in Acworth.	do.	Va. Supply & Well Co.	do.	570	8	do.	71	26	
81	E. side Seminole Dr., in Acworth.	do.	do.	do.	500	8	do.	70	60	
82	Few feet N. of well 83, at Kennesaw National Park.	U. S. Gov't.	do.	do.	450	6	Diorite	3.8	3	Lowland slope.

RECORDS OF WELLS IN COBB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
83	About 0.55 mi. W. of Hwy. 41, 250-300 feet N. of E-W. dirt rd., at Kennesaw National Park.	U. S. Gov't.	Va. Supply & Well Co.	Drilled	51	6	Diorite	4.0	25	Lowland slope.
84	At Kennesaw National Park.	do.	do.	do.	373	6	do.		10	
85	E. side Hwy. 41, 0.4 mi. NW. of Hwy. bridge over N. C. & St. L. R. R.	D. C. Hames	Helms	do.	50.4	6	Injection complex	22.18		
86	About 200 yds. E. of Hwy. 41, just N. of Smyrna city limits.	J. T. Garner	O. V. Helms	do.	120.8	6	do.	34.9		Moderate slope.
87	S. of Spring St., few hundred yds. E. of N. C. & St. L. R. R., in Smyrna.	Town of Smyrna	Va. Supply & Well Co.	do.	131	8	do.	4	110	do.
88	W. side Hwy. 41, 0.2 mi. S. of Smyrna city limits.	J. N. & A. F. Brawner	J. L. Helms	do.	160		Mica schist	30	3	Upland slope.
89	W. side of Nancey St., in Marietta.	City of Marietta		do.	325	8	do.		17	Moderate slope.
90	Few hundred yds. W. of Hwy. 41, S. side City Hall, in Acworth.	Town of Acworth	Va. Supply & Well Co.	do.	500	8	Diorite	33	49	Drawndown 134 ft. Analysis.
91	½ mi. E. of Acworth city limits, between mill & N. C. & St. L. R. R. tracks	Acworth Mills	Ed Fowler	do.	437	8	Diorite-granite	120	38	Temp. 63° F. Iron-bearing water.
92	¾ mi. NW. of Austell near Sweetwater Creek.	Benscot Mineral Waters		do.	900		Granite-gneiss	1	3	Analysis; highly mineralized; known as Artesia-Lithia Well. See Ga. Geol. Survey Bull. 15, p. 205.
93	⅝ mi. NW. of Austell, near Sweetwater Creek.	do.		do.	80	6	do.	5	1	Known as Louch well. See Ga. Geol. Survey Bull. 15, p. 208.

RECORDS OF WELLS IN COBB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
94	⅝ mi. NW. of Austell left bank of Sweetwater Creek.	Benscot Mineral Waters		Drilled	65	6	Granite-gneiss	5	3	Analysis. Medlock Well. See Ga. Geol. Survey Bull. 15, p. 207.
95	¾ mi. NW. of Austell near Sweetwater Creek.	do.		do.	750	2	do.	1	17	Analysis. Sulpho-magnesia well. See Ga. Geol. Survey Bull. 15, p. 203.
96	N. side Southern R. R., in Austell.	Southern Railway		do.	150	6	do.	15	10	Low in mineral matter. Abandoned.
97	½ mi. S. of Austell.	Brunk		do.	110	6	Granite		10	Low in mineral matter.
98	N. side Hwy. 78, 2 mi. W. of Chatt. River.	T. E. Coursey	D. G. Helms	do.	125	6	Injection complex		4	Hillside.
99	N. side Hwy. 78, 0.5 mi. W. of Mt. Harmony Church.	T. D. Gibbs	H. L. Helms	do.	87	6	do.	30	16	Top of upland ridge.
100	0.7 mi. S. of Hwy. 78, 1 mi. SW. of Mt. Harmony Church.	do.	do.	do.	103	6	do.	30	15	do.
101	1.6 mi. NE. of Mt. Harmony Church.	G. B. Tendonfeld	John Morgan	do.	116	6	do.	71	30	Steep hillside.
102	1.3 mi. NE. of Mt. Harmony Church.	Pebble Brook Estates	J. S. Burdick	do.	161.5	6	do.	65	11½	Steep hill.
103	0.4 mi. N. of R. R. Sta., opposite public school, in Mableton.	H. A. Allen	D. G. Helms	do.	100	6	do.	24	7	Hilltop.
104	N. side Hwy. 78, 0.5 mi. E. of R.R. Sta., in Mableton.	F. B. Henson	O. V. Helms	do.	108	6	do.	16	10	Top of upland ridge.
105	S. side Hwy. 78, 1.2 mi. W. of R.R. Sta., in Mableton.	J. B. Gordon	O. V. Helms	do.	163	6	do.		1	Top of upland ridge.
106	0.2 mi. S. of Hwy. 78, 0.9 mi. E. of Hwy. intersection in Austell.	P. S. Hendricks	C. R. Cook	do.	225	6	do.		1	do.

RECORDS OF WELLS IN COBB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
107	0.4 mi. E. of Southern R. R. in Powder Springs, few feet W. of elevated steel water tank, S. side Hwy. 6, in Powder Springs.	Town of Powder Springs	O. V. Helms	Drilled	170	8	Injection complex	25	200	Upland Analysis.
108	N. side Hwy. 78, 1.4 mi. W. of Mt. Harmony Church.	P. L. Harding	D. G. Helms	do.	165	6	do.	25	2	Upland ridge.
109	0.5 mi. N. Hwy. 78, about 1 mi. NE. of Mt. Harmony Church.	Atlanta Girl Scouts	Va. Supply & Well Co.	do.	300	6	do.		5	do.
110	About 2 mi. due E. of Hwy. 3-E, near Chatt. River.	J. D. Smith	J. A. Wood	do.	90	6	do.	15	50	Upland slope.
111	0.2 mi. SE. Hwy. 120, 2.5 mi. due E. of R. R. crossing, in Marietta.	Charles Thomas	do.	do.	186	6	do.		5	do.

RECORD OF SPRING IN COBB COUNTY

	Location	Owner	Name	Source rock	Yield (gallons per minute)	Remarks
A	East side of Powder Creek in Powder Springs.		Powder Springs		1	Analysis.

ANALYSES OF WATER FROM COBB COUNTY

(Parts per million. Numbers at heads of columns correspond to numbers in tables of wells and spring data. Analytical work by Edgar Everhart and L. H. Turner, in Georgia Geological Survey Laboratory; and by A. T. Ness, in Water Resources Laboratory, U. S. Geological Survey.)

Number	15	58	64	65	66	69	79	90	93	94	95	107	A
Silica (SiO_2)	27	22	38	19	34	27	45	18	12	19	19	28	24
Iron (Fe)	0.5	0.43	0.08	0.10	0.09	0.08	0	0.4	....	0.15	0.20	0.1	....
Calcium (Ca)	10	9.8	14	6	32	7.3	22	66	276	340	19	25	28
Magnesium (Mg)	3.3	3.9	6.4	3.6	10	5.4	6.4	17	44	58	60	12	4.8
Sodium (Na)	5.4	12	6.9	3.1	15	4.0	12	1	2,690	2,320	350	Trace	70.8
Potassium (K)	2.2	1.8	2.0	1.5	3.1	1.4	3.5	....	77	....	133	Trace	....
Bicarbonate (HCO_3)	40	33	56	31	103	58	91	82	....	136	141	94	....
Sulfate (SO_4)	16	3.4	1.9	3	25	2.3	6.9	5	582	598	48	6	....
Chloride (Cl)	1.8	15	9.2	4	16	1.5	12	69	3,130	3,820	450	4	107
Nitrate (NO_3)	0.2	20	19	2.5	28	0.10	16	....	....	0	0	0	....
Total dissolved solids	88	119	144	59	226	74	166	480	6,100	7,230	610	135	333
Total hardness as $CaCO_3$	39	40	61	30	121	40	81	253	....	1,090	77	112	....
Fluoride	0	0	0	0	0	0	....	....	....	0.1	0	0	....
pH	....	....	....	....	....	....	....	7.0	....	7.45	7.15	8.4	....
Date of collection	Apr. 22, 1938	Apr. 22, 1938	Apr. 22, 1938	Apr. 22, 1938	Apr. 22, 1938	Apr. 22, 1938	Dec. 6, 1938	Oct. 1, 1946	1901	Jan. 22, 1948	Jan. 22, 1948	Feb. 4, 1948	1911
Analyst	Ness	Ness	Ness	Ness	Ness	Ness	Ness	Turner	Everhart	Turner	Turner	Turner	Everhart

DeKalb County

In 1940 the population of DeKalb County was 86,942. The city of Decatur, with a population of 16,561, is its largest municipality and the county seat. Fulton County abuts DeKalb County on the west, and the eastern suburbs of Atlanta extend into the county at the Decatur city limits. The economy of DeKalb County is divided among interests in greater Atlanta, farming, and the production of granite. The granite, which is quarried in the vicinity of Stone Mountain and Lithonia, has popular appeal as a building stone both in the State and elsewhere. Other activities contributing to the county's economy include textiles, chemicals, metal products, lumber, and furniture.

PHYSIOGRAPHY

The central part of the county is a broad, relatively smooth upland from which small headwater streams flow southward into South River or northward into the Chattahoochee River system. Rising 650 feet above the surface of this upland is the granite boss, Stone Mountain, with its smooth, bald form. In the northern part of the county Nancy Creek and Chattahoochee River have cut deep valleys, producing a rugged topography.

GEOLOGY

The biotite gneiss and schist series is the chief country rock of the county. Several large masses of granite have been emplaced into it, as at Stone Mountain, Lithonia, and in the region near Chamblee. These large granite masses have, generally speaking, rather sinuous surface outlines and show far less concordance to regional structure than do the smaller, lenticular granitic bodies forming the injection complex of the biotite gneiss and schist. Another large discordant intrusive mass, the so-called basic rock, is exposed in the southwestern part of the county. This basic rock is chiefly a pyroxenite, although locally it might be classed as hornblende gneiss. Assimilation of younger granite by the pyroxenite has resulted in formation of dioritic rock along its periphery. Nancy Creek, in the northern part of the county, is intrenched in a northeast-trending belt of rocks, the Brevard schist. The schist is predominantly a fine-grained gray quartz-mica schist, although beds of micaceous quartzite are not uncommon.

GROUND WATER

The rocks of the biotite gneiss and schist series generally yield moderate amounts of ground water where local topographic conditions are favorable. In the Conley area, which is underlain by well-jointed pyroxenite, wells are generally productive. The rocks of the Brevard schist, in the northern part of the county, are relatively poor sources of water supply. Further, this area is extremely hilly, which has an unfavorable influence on ground-water recharge. The granites that underlie a considerable portion of the county, especially in the vicinity of Lithonia, Stone Mountain, and Chamblee, have not been exhaustively explored or utilized as a source of ground water. Except for the bald upland granitic areas, these rocks may be expected to yield ground-water supplies of satisfactory quantity and quality.

MUNICIPAL SUPPLIES

The DeKalb County Water Works supplies water to most of the municipalities in DeKalb County. Although formerly dependent upon wells, such towns as Decatur, Avondale, Chamblee, Doraville, Scottdale, Tucker, and Pine Lake now use surface water from this county system, which is derived from the Chattahoochee River. Raw water is treated by primary settling, coagulation with alum and lime, prechlorination and settling, and filtration. Before distribution a pH adjustment with lime is made, followed by final chlorination. The capacity of this system is reported to be 8 million gallons per day.

Lithonia (population 1,554).—Lithonia derives its municipal supply from Pole Creek, west of the town. Treatment of the raw water consists of coagulation with alum and lime, settling, filtration, and final chlorination. This plant reportedly can process 200,000 gallons of water a day.

Stone Mountain (population 1,408).—The municipal supply of Stone Mountain consists of a combination of spring water and water derived from Stone Mountain Creek. Water from the spring flows into a concrete reservoir and is chlorinated prior to distribution. Raw surface water is treated by coagulation with alum and lime, settling, filtration, and, lastly, chlorination.

Clarkston (population 921).—Clarkston's municipal water supply is derived partly from one deep well, the bulk being obtained, however, from the DeKalb County Water Works. This well is reportedly 448 feet deep, is pumped at the approximate rate of 60 gallons per minute, and yields water of good quality.

RECORDS OF WELLS IN DEKALB COUNTY

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
1	W. side Hwy. 12, 8.2 mi. NW. of Lithonia	DeKalb County (Glen Haven School)		Dug	35	36	Injection complex	19	2	Upland.
2	W. side Hwy. 12, about 8 mi. NW. of Lithonia.	N. R. Jones		do.	43.2	36	do.	39.7		do.
3	W. side Hwy. 12, 6.2 mi. NW. of Lithonia.	Robert Copeland		do.	39.8	36	do.	32.8		do.
4	N. side Hwy. 12, 1.1 mi. NW. of Allen.	Mrs. J. R. Allen		do.	30	36	Granite	19.5		Hilltop.
5	Opposite E. side of office building, about 3 mi. NE. of Lithonia.	Consolidated Quarries Corp.	Hamilton & Sullivan	Drilled	600	10	do.	70	30	
6	Few feet SE. of artificial lake, about 0.2 mi. S. of Gwinnett-DeKalb Co. line.	N. C. Norris	Hulgan	do.	175.5	6	do.	18.6	20	Upland slope.
7	W. side paved, secondary rd., opposite NE. corner School bldg., few feet E. of elevated steel tank, Klondike School.	DeKalb County (Candler School)	Ga. Well Drilling Co.	do.	305	8	do.		10	do.
8	At schoolhouse in Redan, Ga.	DeKalb County (Redan School)	Bentley	do.	250	6	Injection complex		24	
9	On Hwy. 155, in Panthersville, Ga.	L. A. Turnipseed	Va. Supply & Well Co.	do.	126	6	Biotite gneiss		4½	
10	On Hwy. 23, near Chamblee, Ga.	U. S. Government (U. S. Naval Air Station)	do.	do.	155	6	do.	25	7	
11	E. side Boulder Crest Rd., about 1 mi. N. of intersection with Constitution Rd.	P. M. Harden	Massey	do.	388	6		15	3	Upland slope.

RECORDS OF WELLS IN DEKALB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
12	E. side Boulder Crest Rd., 0.5 mi. S. of South River.	Thomas I. Meek		Dug	65.4	36		64	½	Hilltop.
13	N. side Boulder Crest Rd., 0.25 mi. E. of intersection with Cedar Grove Rd.	J. W. Clark	Massey	Drilled	130	8		40	25	
14	2,000 ft. N. of Southern R. R., near City of Atlanta.	W. B. Nathan	do.	do.	235	6		75	10	Hilltop.
15	W. side Gresham Rd., 0.4 mi. S. of Flat Shoals Rd.	Carey Cook	Massey	do.	149	8		28	35	Lowland slope.
16	E. side Hwy. 42, 0.65 mi. N. of Hwy. bridge over Southern R. R.	John Gwin	Massey	do.	101	8	Injection complex	18	35	
17	E. side Hwy. 42, 0.55 mi. S. of Hwy. bridge over Southern R. R.	Mrs. Carrie E. Anderson (formerly Frank Carter)		do.	250	6	do.	259		
18	W. side Hwy. 42, 1.6 mi. W. of Hwy. bridge over Southern R. R.	J. M. Ketchersid	B. H. Ragan	do.	155	6	do.	35	25	
19	S. side of E-W. dirt rd., about 250 ft. E. of Southern R. R. in Conley.	L. L. McPherson	do.	do.	169	7	Pyroxenite	27	50	Hilltop Analysis.
20	E. side 2nd Ave., about 1 mi. N. of Flat Shoals Rd.	Mrs. Wesley Griffin	do.	do.	300	6		18	25	Upland slope.
21	S. side Flat Shoals Rd., opposite junction with 2nd Ave.	Mrs. J. A. Puckett	J. L. Helms	do.	70	6		35		do.
22	N. side Flat Shoals Rd. at 2nd Ave.	Clyde Darby	do.	do.	200	6		55		do.
23	N. side Flat Shoals Rd. at junction with 2nd Ave.	F. M. Holtsinger	do.	do.	235	8		35	35	do.

RECORDS OF WELLS IN DEKALB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
24	0.6 mi. E. of 2nd Ave., about 0.1 mi. N. of Flat Shoals Rd.	Jake Patterson	J. L. Helms	Drilled	197	8			70	Lowland slope.
25	W. side 2nd Ave., 0.2 mi. N. of Flat Shoals Rd.	Sels B. King	Va. Supply & Well Co.	do.	163	6		43.7	10	Upland slope Analysis
26	N. side Glenwood Rd., 0.9 mi. E. of Candler Rd.	Mrs. C. R. McKinney		do.	107	6		50		
27	W. side Columbia Dr., 0.8 mi. NW. of Glenwood Rd.	G. F. Swinney	Massey	do.	172	8		48	15	Hilltop.
28	W. side Columbia Dr., 0.9 mi. NW. of Glenwood Rd.	A. D. Powell	do.	do.	133			16		do.
29	E. side Columbia Dr., 0.8 mi. NW. of Glenwood Dr.	Mrs. A. H. Daniel		do.	111	6		40.5		Hilltop.
30	E. side Columbia Dr., 0.2 mi. NW. of Glenwood Rd.	R. A. Broyles	Hamilton & Sullivan	do.	522	6			1	Abandoned.
31	N. side Flat Shoals Rd., near Gresham Rd.	C. G. Maxwell	J. L. Helms	do.	101	6		40	5	Upland slope.
32	W. side Flat Shoals Rd., 0.2 mi. NW. of junction with Clifton Rd.	M. L. Parks	Bentley	do.	77	6			10	do.
33	0.75 mi. E. of Candler Rd., S. side Panthersville-Wesley Chapel Rd.	R. L. Mathis	J. L. Helms	do.	200	8		40	30	do.
34	S. side Flat Shoals Rd., 0.35 mi. W. of Candler Rd.	I. W. Williams		do.	72	5½		49.6		Hilltop.
35	W. side Candler Rd., 0.8 mi. NW. of Flat Shoals Rd.	Ernest Gladden	J. L. Helms	do.	168	6		4.34	4	Top of ridge.
36	N. side E-W. dirt rd., 1 mi. W. of Flakes Mill Rd.	W. A. Sutton		do.	290	8		40	18	do.

RECORDS OF WELLS IN DEKALB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
37	E. side Columbia Dr., 0.4 mi. S. of Memorial Dr.	B. L. Wade	W. K. Massey	Drilled	103	8			20	Upland slope.
38	W. side Columbia Dr., 0.9 mi. NW. of Glenwood Rd.	A. W. Bailey	do.	do.	100	8		60		do.
39	E. side Columbia Dr., 0.5 mi. NW. of Glenwood Rd.	L. N. Fassett	do.	do.	82	6		39.7		Top of ridge.
40	S. side Glenwood Rd., 0.75 mi. due E. of Candler Rd., few feet W. of Public swimming pool.	Lamar Westfall		do.	300	8		2.8	12	Bottom of valley.
41	0.8 mi. due E. of Candler Rd., N. side McAfee Rd., at dairy.	J. L. Porter		do.	103	6		33	60	Lowland slope.
42	0.75 mi. due E. of Candler Rd., S. side McAfee Rd., at dwelling.	Mrs. C. H. Seavy		do.	98	6		34		Upland slope.
43	0.35 mi. due S. of Glenwood Rd., E. side Austin Rd., at dwelling.	L. L. Leach	J. L. Helms	do.	84			40	8	
44	0.1 mi. due W. of Columbia Dr., N. side Glenwood Rd., at dwelling.	Jeff Mills		do.	69	6			28	Upland slope.
45	0.8 mi. E. of Flakes Mill Rd., N. side Flat Shoals Rd., at dwelling.	E. Z. Huff	Cooke & Fowler	do.	110	8		35	5	Hilltop Analysis.
46	0.3 mi. S. of Flat Shoals Rd., W. side Wesley Chapel Rd., at dwelling in Snapfinger.	Mrs. J. P. Coyne	Va. Supply & Well Co.	do.	272	6			24	Hilltop Analysis.
47	SW. of Lithonia, W. side Pole Bridge Cr., near S. end of mill.	J. L. Sockwell	J. L. Sockwell	do.	490	6	Granite		22	Lowland. Well flows. Massive granites at surface. Analysis.

RECORDS OF WELLS IN DEKALB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
48	0.15 mi. S. of South River, W. side Hwy. 155, at dwelling.	A. L. Bowers	Va. Supply & Well Co.	Drilled	390	6	Granite		1	
49	0.2 mi. S. of small creek, W. side of right-angled turn in Flakes Mill Rd., between tenant's and owner's houses.	C. H. Foster	Economy Well Company	do.	250	6		50	4	Upland slope.
50	E. side Moreland Ave., about 2½ mi. S. of Memorial Dr., at dwelling.	Miss A. M. Lyle		do.	187	6	Biotite gneiss	33.6	1	Hilltop. Never used.
51	1041 Oakdale Rd.	G. U. Steffner	Va. Supply & Well Co.	do.	164	6	do.	30	15	
52	Tucker, Georgia.	O. N. Ewing	do.	do.	347	6	Injection complex		17	Moderate slope.
53	do.	W. L. Cousins		do.	172	6	Mica schist	30	23	
54	32 Berkeley Rd., Avondale.	D. L. Stokes		do.	183	6	Granite gneiss	50	62	
55	1145 Briarcliff Rd., Atlanta.	W. B. Elliott	Va. Supply & Well Co.	do.	100	6			½	
56	261 Madison Ave., Decatur.	W. F. McLendon	do.	do.	313	6	Biotite gneiss	104	7½	Hilltop.
57	116 Columbia Dr., Decatur	C. W. Hunter	do.	do.	546	6	Injection complex		1½	Abandoned.
58	Clarkston.	L. B. Daniel		do.	133	6	Granite			
59	do.	W. J. Atkinson, Jr.		do.	135	6	Mica schist	10	38	

RECORDS OF WELLS IN DEKALB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
60	Panthersville.	U. S. Government (Prison Honor Farm)	Va. Supply & Well Co.	Drilled	605	10	Biotite	36	20.7	Analysis.
61	do.	do.		do.	1150	12	Gneiss	10	43	
62	Briarcliff Rd., Decatur.	Asa G. Candler	Hamilton & Sullivan	do.	680	6	Injection complex		30	Temp. 59° F.
63	do.	do.	do.	do.	980	10	do.		225	Temp. 59° F. Water reported hard.
64	Briarcliff Rd., Decatur.	Asa G. Candler	Hamilton & Sullivan	do.	690	10	do.	60	79	
65	Near Clarkston.	WSB Radio Station		do.	250		do.	20	70	
66	Emory University.	Emory University		do.	622		do.		55	Pumping level 160 ft.
67	9 Covington Rd., Decatur.	W. M. Cantrell	Va. Supply & Well Co.	do.	150	6	do.	45	8	
68	Dunwoody Rd., near Dunwoody.	R. J. Teeple	J. L. Helms	do.	205	6	Quartzite	28	1	
69	Dunwoody.	G. T. Bailey	Ragan Plumbing Co.	do.	191	6	Injection complex		22	
70	Dunwoody Rd., Atlanta.	Mrs. V. G. Atkinson	Va. Supply & Well Co.	do.	500	8	do.	7	2	
71	Redan Road.	W. B. Elliott	do.	do.	200	6	Granite		1	Upland.
72	do.	do.	do.	do.	100	6	do.		½	do.
73	Wesley Chapel Rd., 1 mi. N. of Snapfinger.	T. F. Tarver	do.	do.	124	6	do.	54	4	
74	W. side Hwy. 23, about 0.2 mi. S. of Doraville city limits.	Tupp	T. A. Wood	do.	138	6	Injection complex		7	Ridge on upland.
75	Dunwoody.	W. A. Womack	do.	do.	168	6	do.	45	75	Upland.

RECORDS OF WELLS IN DEKALB COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
76	About 0.7 mi. S. of Dunwoody.	Wayman Spruer	T. A. Wood	Drilled	50	6	Injection complex		20	Upland.
77	About 0.8 mi. S. of Dunwoody.	Ewel Spruer	do.	do.	300	6	do.		3	do.
78	Boulder Crest Drive.	DeKalb County (Boulder Crest School)	do.	do.	150	6	do.	20	30	do.
79	Clarkston.	Town of Clarkston		do.	448	8	do.		60	Analysis.
80	½ mi. N. of Lawson General Hospital, in Chamblee.	T. H. Williams		Dug	40		Biotite gneiss			do.
81	On Ashford-Dunwoody Rd., 1 mi. N. of Peachtree Rd., Atlanta.	H. B. Kirkpatrick	Va. Supply & Well Co.	Drilled	210	8	Injection complex	30	68	

RECORD OF SPRING IN DEKALB COUNTY

	Location	Owner	Name	Source rock	Yield (gallons per minute)	Remarks
A	End of Poplar St., west side of town of Stone Mountain.	Town of Stone Mountain		Granite	18	Flows into concrete reservoir for municipal supply.

ANALYSES OF WATER FROM DEKALB COUNTY

(Parts per million. Numbers at heads of columns correspond to numbers in tables of wells and spring data. Analytical work by L. H. Turner, in Georgia Geological Survey Laboratory; and by W. L. Lamar, in Water Resources Laboratory, U. S. Geological Survey.)

Number	19	25	45	60	79	80
Silica (SiO_2)	20	18	14	....	....	16
Iron (Fe)	1.20	0.5	0.19	1.0	0.15	0.2
Calcium (Ca)	38	0	0	15	21	0
Magnesium (Mg)	4	8	8	....	....	0
Sodium (Na)	0.05	Trace	Trace	....	....	Trace
Potassium (K)	0.03	Trace	Trace	....	....	Trace
Bicarbonate (HCO_3)	....	....	....	55	69	....
Sulfate (SO_4)	14	16	18	20	13	0
Chloride (Cl)	7	10	8	7	4	6
Nitrate (NO_3)	....	....	....	....	....	....
Total dissolved solids	195	108	103	....	....	75
Total hardness as $CaCO_3$	111	....	....	72	63	....
Fluoride (F)	....	....	....	0	0	....
pH	....	7.0	....	....	....	6.5
Date of collection	Aug. 4, 1943	Mar. 4, 1944	Mar. 4, 1944	Apr. 8, 1936	Apr. 8, 1936	July 5, 1945
Analyst	Turner	Turner	Turner	Lamar	Lamar	Turner

Douglas County

Douglas County is in the western part of the area described. The population is rural, except that of the town of Douglasville, the county seat. Agriculture is the leading industry, although textiles and lumbering have some importance. The quarrying of granite, which is boldly exposed in many places, is a potential industry.

PHYSIOGRAPHY

The county is an upland area of the Piedmont Plateau that is undergoing degradation. A pronounced divide extending from Lithia Springs westward through Douglasville to Carroll County has an approximate elevation of 1,200 feet. This divide is being encroached upon by the tributaries of the Chattahoochee River, which are lengthening their courses through headward erosion. The Chattahoochee River, flowing southwestward along the southern boundary of the county, drains the entire county, although the small streams northwest of the divide have long, sinuous courses before reaching the Chattahoochee. As a result of the active cutting by the tributary streams, the entire county is hilly.

GEOLOGY

The rocks of the county have a general northeast trend and a rather steep southeast dip. The Brevard schist, in which the Chattahoochee River is entrenched, forms a belt 2 to 3 miles wide along the southeastern edge of the county. The mica schist of this belt contains many thin quartz stringers, lenses of granite and pegmatite, beds of hornblendic rocks, and micaceous quartzite. All conform to the trend of the schist. The abundance of garnet indicates the extreme metamorphism to which the schist has been subjected.

Northwest of the belt of Brevard schist, and indistinguishable from it except for an increase in granitic material, are rocks of the biotite gneiss and schist series. This zone contains mica schist and hornblendic beds intercalated with granite and forming an injection complex characteristic of this group of neighboring counties. The amount of granitic material increases northwestward until the entire country rock becomes a massive granite. This belt of granite forms the divide connecting Lithia Springs and Douglasville and extending westward.

GROUND WATER

Most of the existing wells in Douglas County are in the Douglasville area, which forms a part of the upland and is underlain by granitic rocks. Most of these wells have relatively low yields because of their location on the top of a granite ridge. Yields from such wells can hardly be expected to exceed 10 gallons per minute. On the other hand, lowland areas underlain by granite should produce satisfactory quantities of ground water.

Very few wells have been drilled into the rock complex of the southeastern part of the county, so that not much is known about the water-yielding properties of those rocks. Owing to the abundance of schistose planes and planes separating individual rock bodies, which provide openings through which water may circulate, wells penetrating these rocks on lowland slopes may yield relatively large amounts of water. Prevailing southeast dips suggest that lowland north-facing slopes may be underlain by water-laden schistose openings constantly recharged by seepage in the lowlands.

MUNICIPAL SUPPLIES

Douglasville (population 2,555).—The only municipal water supply in Douglas County is that of Douglasville, which derives its water from Anneewakee Creek. Treatment of raw water from this creek consists of coagulation with alum and lime, settling, filtering, and chlorination.

Douglas Mill, located on the east side of Douglasville and underlain by granite, has two drilled wells, which supply water for industrial and family use in the mill area. The more productive well, 85 feet deep, is on the lower slope of a ridge and produces 30 gallons per minute. The other well is on higher ground and yields less. Water from these wells is not treated prior to distribution.

RECORDS OF WELLS IN DOUGLAS COUNTY

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
1	N. side Hwy. 78, at School House in Lithia Springs.	Douglas County (Lithia Springs School)	J. L. Helms	Drilled	64	6	Granite	1.5	20	
2	do.	do.	do.	do.	200	6	do.		1	Upland slope.
3	S. side Hwy. 78, in Douglasville.	Town of Douglasville		do.	700	8	do.		20	Hilltop. Never used.
4	S. side Hwy. 78, ½ mi. N. of Douglasville.	Trout Estate		do.	300	8	do.		5	
5	S. side Hwy. 78, 2 mi. W. of Douglasville.	H. Strawn	Helms	do.	185	4	do.	35	3	Upland slope.
6	do.	Pearl Strawn	do.	do.	210	4	do.	50	1	do.
7	7 mi. SW. of Douglasville.	John W. Lee		Dug	75	38	Mica schist	66	2	Hilltop.
8	S. side Hwy. 78, E. side of Douglasville.	Douglas Mills		Drilled	502	6	Granite		8	Hilltop. Considerable drawdown.
9	do.	do.	do.	do.	85	6	do.		30	Lowland slope. Analysis.
10	4 mi. SE. of Douglasville.	W. B. McCollugh		Dug	61	36	Mica schist	58.1	3	Hilltop.
11	S. side Hwy. 78, 2½ mi. E. of Douglasville.	Douglas County (Beulah School)	B. H. Ragan	Drilled	150	4	Granite		3	do.
12	¼ mi. SW. of Lithia Springs	Stanley Agan		do.	105	6	do.		5	Upland slope.
13	N. side Hwy. 78, 4 mi. W. of Douglasville.	T. Burnett	Simpson	do.	65	6	do.		2	Hilltop.
14	do.		do.	do.	110	6	do.		2	Upland slope.
15	N. side Hwy. 78, 2 mi. W. of Douglasville.	Homer Subits	Helms	do.	90	6	do.	45	1	Hilltop.
16	N. side Hwy. 92, 2½ mi. SE. of Douglasville.		do.	do.	70	6	do.		20	Gentle slope.

RECORDS OF WELLS IN DOUGLAS COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
17	S. side Hwy. 92, 2 mi. W. of Douglasville.	Douglas County (Mt. Carmel School)	Helms	Drilled	83	6	Granite		5	Upland slope.
18	3 mi. SE. of Douglasville.	R. D. Lee	do.	do.	114	6	do.		1½	do.
19	3 mi. E. of Douglasville.	County Line Church	do.	do.	85	6	do.		5	do.
20	4 mi. E. of Douglasville.	H. H. Richardson	do.	do.	118	6	Mica schist		5	do.
21	½ mi. W. of Lithia Springs at Sweetwater Park Hotel.			do.	539	6	Granite	20	5	Abandoned.
22	do.	H. C. Martin		Dug	35	36	do.	31		Analysis.
23	In Douglasville.	J. B. Duncan		Drilled	125		do.		None	Reported by S. W. McCallie in Ga. Geol. Survey Bull. 15, p. 210.

RECORDS OF SPRINGS IN DOUGLAS COUNTY

Location	Owner	Name	Source rock	Yield (gallons per minute)	Remarks
A ¼ mile north of Hwy. 78, near Douglas Mills.		Drunkard Spring	Granite	15	Analysis. Spring emerges from contact of soil and hard granite.
B Lithia Springs Golf Course, ¼ mile east of Lithia Spgs.		Old Spring	do.	2	Analysis.
C 300 feet South of B.		Bowden Lithia	do.	3	do.

ANALYSES OF WATER FROM DOUGLAS COUNTY

(Parts per million. Numbers at heads of columns correspond to numbers in tables of wells and spring data. Analytical work by Edgar Everhart and L. H. Turner, in Georgia Geological Survey Laboratory.)

Number	9	22	A	B	C
Silica (SiO_2)	19	6.5	....	48	33
Iron (Fe)	0.1	0.3	....	....	....
Calcium (Ca)	9	9.5	....	88	117
Magnesium (Mg)	6	14	....	6.9	9.1
Sodium (Na)	Trace	16	....	374	1,050
Potassium (K)	Trace	22	....	....	....
Bicarbonate (HCO_3)	1	4	....	....	....
Sulfate (SO_4)	55	1.2	....	....	....
Chloride (Cl)	13	33	8	558	1,100
Nitrate (NO_3)	0	113	....	....	....
Total dissolved solids	125	255	....	1,332	2,290
Total hardness as $CaCO_3$	48	....	....	....	....
Fluoride (F)	....	0.4	0	....	....
pH	5.2	....	7.5	....	....
Date of collection	Jan. 22, 1948	Feb. 1, 1941	Dec. 3, 1947	1911	1911
Analyst	Turner		Turner	Everhart	Everhart

Fulton County

Fulton County is in the central part of the Atlanta area, and is bounded by Cobb and Douglas Counties on the north and west, DeKalb County on the east, and Clayton County on the south. According to the 1940 census, Fulton County had a population of 392,886, most of which was represented by the city of Atlanta and its environs. Atlanta, the county seat and capital of the State, had a population of 302,288. Because of its strategic location in regard to transportation and communication, the city of Atlanta has endowed Fulton County with many and diverse industries and with consequent demands for large quantities of water for industrial and municipal consumption. In addition, many national business establishments have branch offices in the county, from which products are further distributed to other areas of the South over easily accessible transportation routes. Atlanta is the center of a large network of railroads and highways and has one of the busiest airports in the Nation.

PHYSIOGRAPHY

Physiographically, Fulton County is an upland comprising a part of the Piedmont Plateau. The upland, except along the Chattahoochee River, is relatively smooth but, nevertheless, rolling. Dissection of the upland by the Chattahoochee River and its tributaries has produced rather hilly topography in the northern third of the county. Trending diagonally the length of the county and in a southwesterly direction is a rather low, somewhat rounded divide, which separates the drainage system of the Chattahoochee and Flint Rivers. On this divide, which is about 1,000 feet above sea level, Fairburn, College Park, East Point, and Atlanta are located. Atlanta, with an altitude of 1,030 feet, is one of the highest large cities in the country.

GEOLOGY

Biotite gneiss comprises the predominant country rock in the county, although nowhere does it possess a uniform, monotonous character. It includes subordinate amounts of intruded hornblende gneiss and granite which usually occur as lenticular bodies parallel to the schistosity of the country rock. The intrusion of the hornblendic and granitic rocks apparently caused only limited metamorphism. Compared to the biotite and hornblende gneisses, the mica schist, which occurs locally, was altered more by the intrusion of the granite, which caused some recrystallization of mica in the schist as well as the local development of a muscovite-quartz rock in place of the normal feldspar-rich granite.

Rather large and extensive granite masses occur in the Palmetto area and in the Ben Hill section west of East Point, also north of Alpharetta in the extreme north portion of the county. The distinctive feature of the granite at Palmetto is the presence of large phenocrysts of feldspar in a finer-grained groundmass. At Ben Hill the granite is similar, though the large crystals of feldspar are less conspicuous, whereas the granite near Alpharetta is more even-grained and is somewhat gneissic.

Hornblende gneiss occurs as a common rock type in the northern part of the county near Alpharetta. The intimate relation between the hornblende gneiss and the younger granite is apparent here, where an injection complex exists between these two rock types. Trending northeastward and delineated by the valley of Nancy Creek is the belt of Brevard schist. This belt of dark-colored fine-grained mica schist is approximately 7 miles wide.

GROUND WATER

Excluding the belt of Brevard schist north of Atlanta, the biotite gneiss and the schists yield relatively large quantities of ground water. Although many drilled wells have been abandoned during recent years because of inadequate yield, very few have been completely unsuccessful. Rocks of the biotite gneiss and schist series, with their enclosed granite and hornblendic bodies, form the source of most of the ground water in the county.

The rocks of the Brevard schist belt are relatively poor producers of ground water. The unfavorable, hilly terrain, in which the runoff is rapid and the influent seepage low, and the steep dip and compact nature of the rocks prevent adequate storage and circulation of the water, accounting for the limited yield.

The granite areas, notably at Ben Hill and Palmetto, constitute potentially good sources of ground water. Here, as in other granites of the Atlanta area, the largest ground-water supplies should be sought in the lowlands rather than on the hilly uplands. At Ben Hill, for example, experience has shown this to be true.

MUNICIPAL SUPPLIES

Atlanta (population 302,288).—Although formerly dependent upon ground water for its source of supply, today Atlanta derives its municipal water supply from the Chattahoochee River. Treatment of the raw water consists of preliminary sedimentation and prechlorination, coagulation with alum, sedimentation, addition of activated carbon, filtration, and final pH adjustment with lime and postchlorination. The capacity of the Atlanta Water Works is reportedly 72 million gallons per day.

Although Atlanta now derives its municipal water supply from the Chattahoochee River, an appreciable number of deep wells, chiefly in the industrial areas, are now being used. At the present time most of the water furnished by these wells is used for industrial purposes. Also, during recent years there has been a noticeable trend toward utilization of ground water for air conditioning in industrial plants and hotels.

Geology of industrial Atlanta.—The lack of fresh rock exposures within the city makes a description of the geology difficult. However, limited observations indicate the predominant rock to be a biotite granite gneiss with subordinate sheets of hornblende gneiss. Locally, within the biotite gneiss, belts of mica schist and thin intercalated granite stringers occur. This schist-granite complex is exposed on Glenn Street south of the State Capitol and near the intersection of Spring and Baker Streets. A porphyritic granite gneiss containing practically no biotite crops out in West End along Gordon Road and extends northward almost to the junction of Hollywood Road with Marietta Road. All these rocks in Atlanta display parting planes along the schistosity. Further, the gneisses are exfoliated in varying degrees, and this has opened an additional set of joints which approximate the horizontal. The regional dip of the schistosity normally is a little less than 40° to the southeast, and wells drilled into the rock generally intersect a number of water-filled openings along schistose planes, as well as any exfoliation openings that are present. In comparison with other areas of crystalline rocks, the regional and local structure of Atlanta favors the storage and circulation of moderately large quantities of ground water.

Ground water in the industrial areas of Atlanta.—The total amount of water extracted from wells within Atlanta proper is not large. Considerably more water probably could be withdrawn before the total rate of withdrawal would exceed the rate of replenishment. However, it should be noted that the present rate of replenishment is thought to be somewhat lower in the area comprising the inner zone of the city than it was in the year 1900, for example. This has been brought about, in all probability, by increased surface runoff and evaporation due to the building of impervious road pavements, buildings, and other man-made structures that occupy the surface space and so reduce the amount of water available for influent seepage. A drilled well owned and operated by the Ansley Hotel in downtown Atlanta, for example, has no nearby intake area because its immediate neighborhood is completely built up. This well must therefore draw water from a greater distance than would be necessary for an ordinary well situated elsewhere in the Atlanta area.

The well at the Ansley Hotel is considered typical of industrial wells in Atlanta, though somewhat deeper than the average. This well is approximately 750 feet deep, is 10 inches in diameter, and contains casing set in fresh granite gneiss at a depth of 42 feet beneath the land surface. According to the driller's report the static level was 44 feet following completion of the well and the pumping level was 180 feet when the well was pumped at the rate of 68.7 gallons per minute for a period of 36 hours.

Wells penetrating only biotite gneiss should yield water moderately low in mineral content. However, the ubiquitous dark-colored hornblendic beds in many parts of Atlanta cause the ground water from these areas to be rather highly mineralized. For example, water from well 42 had total solids amounting to 390 parts per million.

East Point (population 12,403).—Approximately 22 deep wells have been drilled at one time or another in the East Point area for a municipal water supply. However, not all these wells were successful. By 1943 the city was obtaining its water supply from about 15 wells, most of which were being pumped at that time. Five of these wells were near the city waterworks plant, and were pumped by air lift. Ten others were dispersed about the city and were pumped by electric turbine pumps set in the wells at an average depth of 150 feet. During the spring and summer of 1939, according to report, the combined yield of these wells was 1,200,000 gallons per day, but because of the prolonged dry autumn of that year the combined yield dropped to about 800,000 gallons per day. By 1945 the city had grown to such size that the available ground-water supplies were no longer adequate to meet existing needs. During 1945, therefore, the city abandoned its wells and began using surface water, which has since been its source of municipal water supply. The new plant at the present time has a reported daily capacity of 2 million gallons. Water for the supply is derived from Sweetwater Creek, in Cobb County, and is treated by preliminary sedimentation, sterilization with chlorine dioxide, coagulation with alum and lime, settling, filtration, and final pH adjustment with lime prior to distribution.

The predominant rock type in the East Point area is a biotite gneiss, freshly exposed in a rock quarry on Sylvan Road south of Lakewood Avenue. On the south side of town is exposed some mica schist intercalated with granite lenses. The west side of town is underlain by massive granite extending westward to Ben Hill.

As previously indicated, many drilled wells in East Point have had relatively high yields compared to other wells in areas underlain by crystalline rocks. There is, however, considerable variation in the yields of the different wells owned and formerly operated by the city of East Point, the average yield approximating 50 gallons per minute. After a period of continuous use certain wells have shown a progressive reduction in yield. For example, Fulton County well 21, according to report, originally yielded 240 gallons per minute, but later fell off to 175 gallons per minute. Such reduction in yield has been noted in the East Point area as well as in other parts of the Atlanta area.

As in the industrial part of Atlanta, the prevalence of lenses of hornblende gneiss in the East Point area has led to considerable variety in the quality of ground water in that area. In wells failing to penetrate hornblende gneiss or a comparable rock, the water is likely to be soft and somewhat acid, and may or may not contain an objectionable quantity of iron. The presence of hornblende gneiss sometimes tends to increase the iron content, and also the total hardness. The practice generally followed in the removal of objectionable amounts of iron from well waters in this area has been that of aeration and the addition of lime.

College Park (population 8,213).—By 1943 a total of nine wells had been drilled in College Park for a municipal water supply. Of these, five were being actively pumped. According to report, each of the five wells had a yield of 100 gallons per minute. The remaining four wells were eventually abandoned because their yields declined to such an extent that pumping was uneconomical. Because the available ground-water supply was insufficient to meet existing demands, a small lake yielding approximately 150 gallons per minute was utilized as a supplemental water supply. The lake water was mixed with water from three of the wells and the mixture was treated and filtered at the waterworks plant. Since 1945 College Park has been purchasing additional water from the surface-water plant owned and operated by the City of East Point. At present water from the lake is no longer used. The part of the municipal water supply derived from wells receives treatment consisting of aeration, coagulation with alum and lime, filtration, chlorination, and, finally, pH adjustment with lime prior to distribution to the users.

The geologic and ground-water conditions in College Park are essentially similar to those in East Point. Much of the College Park area is underlain by southeastward-dipping biotite gneiss, which is freshly exposed in a quarry on the College Park golf course. The average yield of municipal and industrial wells is approximately 50 gallons per minute. In quality the ground water in the College Park area closely approximates that of East Point, though the water from most wells appears to contain less iron.

Hapeville (population 5,059).—The history of the municipal water supply in Hapeville has closely paralleled that of College Park. The municipal supply, originally derived from wells, is now supplemented by treated surface water purchased from the city of Atlanta. In June 1947, Hapeville consumed approximately 19,000,000 gallons of water, of which 15,000,000 gallons was obtained from Atlanta, the remainder coming from three wells. Of these, wells 44 and 45 are being pumped at the rate of 80 gallons per minute each, and well 46 at the rate of 28 gallons per minute. The well water is not treated prior to distribution.

The same belt of biotite gneiss present in College Park extends northeastward into Hapeville, where it underlies the entire town. The foliation and many of the accompanying parting planes have a moderate dip to the southeast. Because of the favorable geology and topography, Hapeville is an area of successful wells. Of nine wells on which data are available, none yielded less than 20 gallons per minute; the average yield was 52 gallons per minute. The average depth of these wells is 616 feet. Well waters in the Hapeville area are only moderately mineralized and are suitable for domestic and industrial use.

Alpharetta (population 647).—Two drilled wells furnish the municipal water supply of Alpharetta. One well is reported to be 247 feet deep and yields 40 gallons per minute. The other well is reportedly 300 feet deep and yields 75 gallons per minute. Because the town is underlain by well-jointed interbedded hornblende gneiss and granite, fairly high yields may be expected from wells drilled in this area. Where a considerable quantity of dark-colored hornblende gneiss is encountered, some hardness and a fairly high iron content may be expected in the water. Although water from the more recently drilled well is untreated, that from the old well receives treatment to remove carbon dioxide, followed by chlorination.

Fairburn (population 1,502).—Formerly the City of Fairburn utilized ground water for its municipal supply, but within comparatively recent time it has changed to surface water.

Treatment of the raw water consists of coagulation with alum and lime, settling, filtration, and chlorination. The capacity of the water works is reportedly around 190,000 gallons per day.

Palmetto (population 1,029).—The history of Palmetto's municipal water supply is similar to that of the neighboring town of Fairburn. Today Palmetto uses water from Cedar Creek, the present plant having a reported daily capacity of 144,000 gallons. Treatment of the raw water consists of coagulation with alum and lime, settling, filtration, and chlorination.

Roswell (population 1,622).—Although located in the opposite end of Fulton County, Roswell's municipal water supply, including capacity of the plant and treatment, is similar to that of Palmetto. Roswell derives its water from Big Creek.

Union City (population 884).—The town of Union City derives its municipal water supply from two deep wells, only one of which is being used at present. The well furnishing the municipal supply reportedly yields 70 gallons per minute. The water from this well is treated for removal of carbon dioxide and pH adjustment.

Fort McPherson Military Reservation.—More than a dozen wells have been drilled on the Fort McPherson Military Reservation, near the southwest limits of Atlanta. Until 1917 the reservation was supplied with water from six wells, at which time the city of Atlanta began furnishing the Fort with surface water. Efforts during the recent war to develop an independent ground-water supply for emergency use apparently were successful, although the wells drilled on the reservation during this period have never been utilized.

The rock encountered in drilling in this area is a biotite granite gneiss with occasional lenses of pegmatite and hornblende gneiss. The foliation, along which most of the parting planes are aligned, has a moderate to steep southeast dip.

Of 10 wells owned by Fort McPherson on which accurate data are available, yields range from 5 to 133 gallons per minute, the average being 44 gallons per minute. The average depth of the wells is 457 feet. The normal pumping level is approximately 160 feet.

RECORDS OF WELLS IN FULTON COUNTY

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
1	E. side Harvard Ave., in College Park.	City of College Park	Va. Supply & Well Co.	Drilled	600	12	Injection complex		100	Temp. 65° F. Drawdown 100 ft.
2	S. side Jackson St., in College Park.	do.	Ga. Well Drilling Co.	do.	350	12	do.	12	100	Temp. 72° F. Pump bowls set 190 ft.
3	N. side Francis St., in College Park.	do.		do.	550	12	do.		50	Temp. 64° F. Analysis.
4	S. side Cambridge Ave., near small lake, in College Park.	do.		do.	500	12	do.	60	75	Analysis.
5	W. of Wiley St. extended, near Camp Hill, in College Park.	do.	Ga. Well Drilling Co.	do.	305	12	Granite	12	100	
6	At Water Works, in College Park.	do.		do.	600	8	Injection complex	40.36	10	Abandoned.
7	do.	do.	Ga. Well Drilling Co.	do.		10	do.	41.03	10	do.
8	E. side Oglethorpe St., in College Park.	do.		do.		10	do.	55	15	Iron 6 ppm. Yield in 1930, 60 g.p.m.
9	W. of Center St. extended, near small stream, in East Point.	City of East Point	Hamilton & Sullivan	do.	552	10	Granite		40	Drawdown 140 ft. Water contains considerable iron.
10	N. side Spring St., in East Point.	do.	do.	do.	600		Injection complex	13	36	Temp. 63° F. Drawdown 137 ft.
11	S. and W. of St. Michael St. extended, near small creek in East Point.	do.	do.	do.	510	10	do.		20	Temp. 62° F.
12	E. side Cleveland Ave., near small creek, in East Point.	do.	do.	do.	635	10	do.		45	Analysis; considerable iron.
13	S. side Jefferson Ave., at head of small creek, in East Point.	do.	do.	do.	500	10	do.		40	Temp. 63° F. Analysis.

RECORDS OF WELLS IN FULTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
14	N. side Wadley Ave., in East Point.	City of East Point	Hamilton & Sullivan	Drilled	400	8	Injection complex	44	90	Analysis. Contains considerable iron. Drawdown 122 ft.
15	E. side Harris St., in East Point.	do.		do.	490	10	do.		35	Lowland. Temp. 63° F.
16	N. side Cleveland Ave., in Chambers Pk., near small creek, in East Point.	do.	Pat Murray Equipment Co.	do.	402	10	do.	15	75	Temp. 60° F.
17	Few feet E. of elevated steel water tank, W. of Plant St., in East Point.	do.	Hamilton & Sullivan	do.	530		do.	54	70	Temp. 62° F.
18	Few hundred yds. W. of Roosevelt Hwy. near circular R. R. siding in East Point.	do.	do.	do.		10	do.	90	40	Top of ridge.
19	N. side Taylor Ave., few hundred yds. NW. of Water Wks., in East Point.	do.	L. C. Dew	do.	500	10	do.	60		Temp. 61° F.
20	E. side Plant St.,S. side concrete reservoir at Water Wks., in East Point.	do.	Hamilton & Sullivan	do.	250	10	do.	58.5	20	Yield affected by pumping of nearby wells.
21	About 100 yds. E. of well 20 in East Point.	do.	L. C. Dew	do.	500	8	do.	39	175	Temp. 62° F. Original yield 240 g.p.m.
22	E. side Plant St., few ft. W. of Marion Harper Mill, in East Point.	do.		do.	563		do.	75	16	
23	E. side Plant St., few ft. W. of Water Works, in East Point.	do.	Hamilton & Sullivan	do.	684	8	do.	60	40	
24	Inside Marion Harper Mill, in East Point.	do.		do.	377	6	do.	49	20	

RECORDS OF WELLS IN FULTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
25	N. side Holcomb St., at Level St., in East Point.	City of East Point	Hamilton & Sullivan	Drilled	523	10	Injection complex	165		Filled with debris.
26	S. side Cleveland Ave., between O'Neil Bros. warehouse & Central Georgia R. R.	O'Neil Bros.	—	do.	350	10	do.	19	12	Abandoned for 10 years.
27	W. side Church St. at Dorsey St., near public school, in East Point.	City of East Point	Hamilton & Sullivan	do.	540		Granite		8	Never used.
28	2888 Habersham Rd., in Atlanta.	J. O. H. Sanders	Va. Supply & Well Co.	do.	140	8	Injection complex	35	10.9	
29	E. side Central Ave., near SE corner fertilizer plant, in East Point.	Adair & McCarthy		do.	300	6	do.	13.8		Filled with debris.
30	2½ mi. W. of East Point on Hogan Rd., in East Point.	W. J. Barnwell	Va. Supply & Well Co.	do.	135	8	Granite	40	5	Drawdown 95 ft.
31	At Conley Pk., near small creek, in East Point.	City of East Point	do.	do.	600	10	do.	12.64	20	Never used.
32	W. side Central Ave., on W. side fertilizer plant, in East Point.	International Minerals & Chemical Corp.	L. C. Dew	do.	506		Injection complex	30.7	15	Original yield 50 g.p.m.
33	E. side Central Ave., near small creek, in East Point.	Swift & Co.		do.	50	6	do.	6.88		
34	E. side Central Ave., NE. corner of fertilizer plant, in East Point.	Henry Channin		do.	350	10	do.	16		Temp. 63° F.
35	E. side Central Ave., near NW. corner fertilizer plant, in East Point.	Tennessee Corp.		do.	300	6	do.	28	6	
36	do.	do.		do.	550	6	do.		75	

RECORDS OF WELLS IN FULTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
37	W. side Central Ave., N. side of center bldg., in East Point.	Piedmont Cotton Mill	Hamilton & Sullivan	Drilled	465	6	Injection complex		100	Water reported hard. Temp. 63° F.
38	S. side Spring St., NE. of NE. corner of cotton mill in East Point.	Gate City Cotton Mill	Va. Supply & Well Co.	do.	717	8	do.	28.2	60	High in magnesium.
39	S. side Spring St., S. side of mill, in East Point.	do.		do.	900	6	do.	13.5	100	High in magnesium. Abandoned.
40	W. side Roosevelt Hwy., near NE. corner of plant, in East Point.	Terra Cotta Co.		Dug	35		do.	33		
41	At Five Points, in Atlanta.	City of Atlanta		Drilled	2175		do.		33	Abandoned 50 years ago.
42	249 Peters St., in Atlanta.	Schaffners Poultry & Hatchery Co.	Va. Supply & Well Co.	do.	250	6	do.	25	39	Drawdown 125 ft. Analysis.
43	E. side Central Ave., opposite E. side fertilizer plant, in East Point.	American Agriculture & Chemical Co.		do.	300	10	do.	19.8		Abandoned.
44	E. side Jonesboro Rd., near small creek, in Hapeville.	City of Hapeville		do.	600	10	do.	60	75	Analysis. In use.
45	W. side Atlanta Ave. at Georgia Ave., in Hapeville.	do.		do.	803	10	do.	59.8	80	Temp. 66° F. Analysis. In use.
46	E. side Oakdale Rd. at North Ave., in Hapeville.	City of Hapeville		do.	616	10	do.	70	35	Temp. 64° F. Abandoned.
47	W. side Sims St. at North Ave., in Hapeville.	do.		do.	600	10	do.	57	75	Lowland slope. Abandoned.
48	E. side Clay Pl. at Virginia Ave., in Hapeville.	do.		do.	825	10	do.	66	55	Abandoned.
49	E. side Fulton St., opposite SE. corner of City Hall, in Hapeville.	do.		do.	600		do.		55	Abandoned.

RECORDS OF WELLS IN FULTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
50	W. side Central Ave., opposite NW. corner of Main Bldg., in Hapeville.	Georgia Baptist Orphans Home		Drilled	564	6	Injection complex		30	Water forms boiler scale.
51	W. side of Reservation near small creek at Ft. McPherson.	U. S. Government	L. C. Dew	do.	450	10	do.	32	32	
52	About 260 ft. NW. of well 51, at Ft. McPherson.	U. S. Government	L. C. Dew	do.	500	8	do.	22	35	Lowland slope.
53	About 250 ft. W. of well 52, at Ft. McPherson.	do.	do.	do.	500	8	do.		5	
54	About 250 ft. S. of Campbellton Rd., at Ft. McPherson.	do.		do.	250	8	do.	26.2	21.5	Hilltop.
55	About 375 ft. S. of Campbellton Rd., at Ft. McPherson.	do.		do.	500	10	Biotite gneiss	26.3	65	
56	About 25 ft. W. of well 55, at Ft. McPherson.	do.		do.	500	10	Injection complex		5	Hilltop.
57	W. of Roosevelt Hwy. near elevated steel water tank, at Ft. McPherson.	do.		do.	689	12	Biotite gneiss	30	20	Casing to 113 ft.
58	S. end of Reservation about 800 ft. W. of Roosevelt Hwy., near wooden barracks, at Ft. McPherson.	do.		do.	300	12	do.	12	66.	Drawdown 100 ft.
59	S. end of Reservation, about 260 ft. W. of Roosevelt Hwy., at Ft. McPherson.	do.		do.	338	12	do.	8	20	do.
60	S. end of Reservation, about 30 ft. W. of Roosevelt Hwy., near well 59, at Ft. McPherson.	do.		do.	651	12	do.	17	136	

RECORDS OF WELLS IN FULTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
61	SE. corner of Reservation, about 475 ft. W. of Roosevelt Hwy., at Ft. McPherson.	U. S. Government	Va. Supply & Well Co.	Drilled	400	12	Biotite gniess	25		Analysis.
62	2.4 mi. SW. of main intersection in Fairburn, 0.3 mi. W. of Hwy. 29.	E. C. Creel	do.		173	6	Injection complex	42		
63	W. side Hwy. 29, about 2 mi. SW. of College Park.	College Park Land Corp.		do.	128	6	Granite	50	16	
64	W. side Hwy. 29, 0.3 mi. E. of R. R. Sta. at Red Oak.	Sewell Hats Inc.	Hamilton & Sullivan	do.	600	8	Granite	10	19	
65	W. side Hwy. 29; few hundred yds. W. of well 64.	do.	do.	do.	200	8	do.		19	Upland.
66	About 0.5 mi. N. of Hwy. 29, at Prison Camp, in Stonewall.	Fulton County (Prison Camp)		do.	130	8	do.		30	
67	About 0.8 mi. E. of Hwy. 29, in Union City.	Union City	Ga. Well Drilling Co.	do.	200	10	do.		18	Never used.
68	Few hundred yds. S. of well 67, in Union City.	do.	do.	do.	202	10	do.		70	Foot of hill.
69	About 0.2 mi. E. of Hwy. 29, in Fairburn.	City of Fairburn		do.	900	10	do.			Well dry. Cased to bottom.
70	E. side Hwy. 29, about 0.4 mi. S. of town of Fairburn.	City of Fairburn		do.	600	8	Granite			Cased to bottom.
71	About 0.3 mi. N. of well 69, in Fairburn.	do.		do.	600	6	do.		15	Hilltop.
72	748 Rice St. NW., in Atlanta.	Sydel-Woolley Co.	Va. Supply & Well Co.	do.	450	8	Injection complex	38	110	Drawdown 65 feet.
73	Palmetto	Palmetto Cotton Mill	Hamilton & Sullivan	do.	800		Granite		9	

RECORDS OF WELLS IN FULTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
74	N. side Hwy. 78, opposite Mason School, in Bolton.	Cochran Barbecue	J. L. Helms	Drilled	122	6	Granite gneiss	34.7	8	
75	E. side Bolton Rd. opposite well 74, in Bolton.	Pure Oil Co.	do.	do.	144	8	do.	32.0	30	Drawdown 80 ft.
76	S. side Hwy. 78, near SE. corner of Mason School, in Bolton.	Fulton County (Mason School)	do.	do.	110	6	do.	40.1	8	
77	E. side Bolton Rd., ¼ mi. N. of Hwy. 78, in Bolton.	Cora C. Helms	do.	do.	84	8	do.	20.9	16	
78	Howell Mill Rd. and 14th St. in Atlanta.	White Provision Co.		do.	432		Injection complex	35	35	Analysis.
79	do.	do.		do.	450		do.		60	Drawdown 100 ft.
80	W. side Bolton Rd., ½ mi. N. of Hwy. 78, in Bolton.	Mrs. J. C. Garrett		Dug	35.9		Granite gneiss	14.3		
81	1365 Mecaslin St., NW., in Atlanta.	Atlantic Steel Co.		Drilled	350	8	Injection complex	30	110	Abandoned.
82	Several hundred yds. W. of Southern R. R., near tenement houses, in Bolton.	Chattahoochee Brick Co.	J. L. Helms	do.	58.2	6	Mica schist	14.2		Lowland slope.
83	5195 Northside Dr., in Atlanta.	J. B. Hill	Va. Supply & Well Co.	do.	125	6	Injection complex		3	
84	About 30 yds. E. of Well 82, in Bolton.	Chattahoochee Brick Co.		Dug	34		Mica schist	17		
85	W. side Hwy. 41, in Hapeville.	Atlanta Band Mill		Drilled	450	10	Injection complex	30		
86	West View Cemetery, Gordon St., in Atlanta.	West View Corp.		do.	600	8	Granite		58	Pumping level 200 ft. below surface.
87	Childress Dr., SW., in Atlanta.	W. B. Tidwell	Economy Well Drilling Co.	do.	360	6	do.		20	

RECORDS OF WELLS IN FULTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
88	do.	J. P. Gossett	Ragan Plumbing Co.	Drilled	307		Granite		6	
89	W. side Moreland Ave. 0.75 mi. N. of Southern R. R., in Atlanta.	R. M. Thompson		do.	250		Injection complex		20	Near top of hill.
90	743 McDaniel St., SW., in Atlanta.	Liquid Carbonic Co.	Va. Supply & Well Co.	do.	107	10	Injection complex			Abandoned.
91	do.	do.	do.	do.	702	10	do.	24		
92	2278 Virginia Pl., NE., in Atlanta.		do.	do.	325	8	Granite gneiss		30	
93	175 Peyton Rd., SW., in Atlanta.	W. F. Cox	do.	do.	300	6	Granite		15	
94	Custer Ave., SW., in Atlanta.	J. A. Davis	do.	do.	134	6	Biotite gneiss		3	Hilltop. Static level 64 ft.
95	36 Butler St., SE., in Atlanta.	Grady Memorial Hospital		Dug	42		Injection complex		4	Slotted casing to total depth. Abandoned.
96	1700 Howell Mill Rd., in Atlanta.	United Butchers Abbatoir	do.	Drilled	250	8	do.	128	6	Upland slope.
97	do.	do.	do.	do.	135	8	do.	105	14	do.
98	do.	do.	do.	do.	500	8	do.	45	6	
99	978 Bruce Circle, in Atlanta.	Mrs. E. B. Buffington	do.	do.	112	6	Biotite gneiss	62	5	
100	976 Sloan Circle, in Atlanta.	Mrs. J. N. Smith	do.	do.	102	6	do.	23	1	
101	E. Roxboro Rd., in Atlanta.	H. S. Reagan	do.	do.	230	6	Injection complex		1	Upland slope.
102	Hogan Rd., in East Point.	W. E. Hancock, Jr.	do.	do.	100	6	Granite		3½	
103	do.	do.	do.	do.	103	6	do.	18	4	Drawdown 85 ft.

RECORDS OF WELLS IN FULTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
104	North Ave. at McAfee St. in Atlanta.	Georgia School of Technology	Va. Supply & Well Co.	Dug	51		Mica schist	24		Test hole.
105	98 Forsyth St. in Atlanta	Ansley Hotel	do.	do.	750	10	Granite gneiss	44	68.7	
106	150 East Ave., NE., in Atlanta.	Georgia Baptist Hospital	do.	do.	700	10	Injection complex	42	69	
107	W. Paces Ferry Rd., in Atlanta.	Paul Sydell	do.	do.	98.6	6	Mica schist	12	5	
108	W. of Paces Ferry Rd., in Atlanta.	Mrs. McClain	do.	Drilled	280	6	Injection complex	40	12	
109	1428 Peachtree St., NE., in Atlanta.	Pershing Hotel	Hamilton & Sullivan	do.	700	8	do.		8	Abandoned.
110	0.7 mi. N. Hwy. 29, about 1½ mi. NE. of Union City	Houston White	Va. Supply & Well Co.	do.	350	8	Granite		12	Upland slope.
111	725 Humphries St., SW., in Atlanta.	National Fruit & Produce Co.	do.	do.	750	10	Injection complex	20	52	Analysis. Pumping level 220 ft. below surface.
112	Atlanta & Foundry Sts., in Atlanta.	Atlanta Gas Light Co.		do.	278	8	do.		150	
113	Davis St. near Jones Ave., in Atlanta.	Georgia Railway & Electric Co.		do.	350	14	do.	12	52	
114	do.	do.		do.	638	14	do.	12	55	
115	1365 Mecaslin St., NW., in Atlanta.	Atlantic Steel Co.		do.	508	10	do.	58	130	Temp. 60° F. Draw-down 37 ft.
116	Lee St., near Lakewood Ave., in Atlanta.	Central of Ga. R. R.	Va. Supply & Well Co.	do.	308	10	Injection complex	1.5	100	
117	do.	do.		do.	151		do.		183	
118	2986 Grandview Ave., in Atlanta.	H. W. Evans	do.	do.	177	6	do.	10		

RECORDS OF WELLS IN FULTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
119	2278 Virginia Pl., NE., in Atlanta.	Peachtree Hills Apts.	Va. Supply & Well Co.	Drilled	193	8	Granite gneiss		10	
120	1590 Northside Dr., NW., in Atlanta.	Walker Electric Co.	do.	do.	321	8	do.		45	Temp. 55° F.
121	1020 Custer Ave., in Atlanta	W. C. Pittman	Atlanta Well Drilling Co.	do.	104	6	Biotite gneiss	30	5	Steep slope.
122	575 Ponce de Leon Ave., in Atlanta.	Sears-Roebuck & Co.		do.	740		Injection complex	42	30	Drawdown 120 ft.
123	Alpharetta.	Town of Alpharetta		do.	247	10	Horn-blende gneiss		40	Considerable Fe in water. Yield 60 g.p.m. originally.
124	do.	do.		do.	300	10	do.		75	Moderate slope. Pump set at 120 ft.
125	Ben Hill.	George Waits	Morgan	do.	154	6	Granite	15	8	Upland slope.
126	do.	C. P. Zuber	Helms	do.	145	6	do.	20	37	Moderate slope.
127	do.	Mr. Hollingsworth	do.	do.	91	6	do.		2½	
128	do.	Ben Hill Civic Club		do.	450	8	do.		8	
129	do.	Samuel Pass		do.	135	6	do.	10	40	Lowland slope.
130	1290 Fairburn Rd., in Atlanta.	Fred Landers	Helms	do.	85	6	Hornblende gneiss	52	6	Hilltop.
131	3370 Nancy Creek Rd., in Atlanta.	John A. Dodd	Va. Supply & Well Co.	do.	155	6	do.	16	27½	
132	647 Northside Dr., NW., in Atlanta.	Earl McMillen	do.	do.	165	6	Injection complex	40	12	
133	2 W. Muscogee St., in Atlanta.	Mills B. Lane, Jr.	do.	do.	460	6	do.	74	18½	Upland slope.
134	700 McDonough Blvd., in Atlanta.	Fred L. Brown	do.	do.	175	6	Mica schist		1	

RECORDS OF WELLS IN FULTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
135	5060 Powers Ferry Rd., in Atlanta.	W. H. Stadelman	Va. Supply & Well Co.	Drilled	165.6	6	Injection complex	44	12	
136	887 W. Marietta St., NW., in Atlanta.	King Plow Co.	Hamilton & Sullivan	do.	350	6	do.	35	57	Water reported hard.
137	40 Stovall Blvd. N. E., in Atlanta.	J. H. Harrison	Va. Supply & Well Co.	do.	200	6	do.	16	7	
138	210 Peachtree St., in Atlanta.	Henry Grady Hotel		do.	710	10	do.	39	90	Drawdown 130 ft. Used for air conditioning.
139	3810 Wieuca Rd., NE., in Atlanta.	A. L. Belle Isle	B. H. Ragan	do.	325	6	Chlorite schist		6	Moderate slope.
140	598 Wells St., in Atlanta.	Atlanta Woolen Mills		do.	605	8	Injection complex		50	Upland slope.
141	3661 Tuxedo Rd., NW., in Atlanta.	Lawrence Willet	B. H. Ragan	do.	225	6	Mica schist		22	
142	3658 Tuxedo Rd., NW., in Atlanta.	A. A. Acklin	do.	do.	130	6	do.		30	Used for irrigation.
143	Campbellton Rd., SW., in Atlanta.	Black Rock Country Club	Ragan Plumbing Co.	do.	150		Granite		22	In lowland.
144	1016 W. Paces Ferry Rd., NW., in Atlanta.	Luther Randall	do.	do.	161		Mica schist		22	
145	1½ mi. N. of Roswell, N. of Chattahoochee River.	John Blick	do.	do.	95	6	Hornblende gneiss		6	
146	1400 Murphy St., in Atlanta.	National Biscuit Co.	Murphey Equip. Co.	do.	376	6	Injection complex		77	Upland slope.
147	do.	do.	do.	do.	575	6	do.		11	do.
148	2811 Andrews Dr., in Atlanta.	Howard Hailey	Helms	do.	118	4	do.	3	20	Total hardness 68 p.p.m.
149	Lakewood Ave. & Pryor St., near Sausage factory.	J. B. Davis	B. H. Ragan	do.	181	6	do.		17	Moderate slope.

RECORDS OF WELLS IN FULTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
150	W. side Hwy. 29, about 0.5 mi. SW. of College Park city limits.	Rufus Betsill	B. H. Ragan	Drilled	163	6	Granite		3	Casing to 70 ft.
151	40 Wood St., NW., in Atlanta.	Frank Mayo	do.	do.	163	6	Injection complex		30	
152	112 Krog St., in Atlanta.	Atlanta Stove Co.	Murphey Well Drilling Co.	do.	192	8	do.	30	26	Casing to 50 ft.
153	794 Marietta St., NW., in Atlanta.	Exposition Cotton Co.		do.	575	6	Granite gneiss	40	50	Upland slope.
154	do.	do.		do.	500	8	do.	18	80	Lowland slope.
155	536 Manford Rd., SW., in Atlanta.	M. W. Harmon	Va. Supply & Well Co.	do.	170	8	Injection complex	15	51	
156	106 Washington St., in Atlanta.	Atlantic Ice & Coal Co.		do.	300	6	do.		60	Abandoned.
157	Old Hapeville Rd., in Hapeville.	W. D. Gatehouse	Va. Supply & Well Co.	do.	198	6	do.	65	4½	
158	170 Boulevard Rd., in Atlanta.	Fulton Bag Cotton Mill.		do.	715		do.		25	
159	do.	do.		Dug	94		do.			
160	E. side Hwy. 74, ½ mi. S. of Fairburn.	F. D. Duffey	B. H. Ragan	Drilled	129	6	Granite		6	
161	Old Marietta Hwy. near Chattahoochee River, in Bolton.	Campbell Coal Co.	Va. Supply & Well Co.	do.	303	6	Schist	35	22	
162	1365 Mecaslin St., NW., in Atlanta.	Atlantic Steel Co.		do.	450	12	Injection complex	35	70	Pump set at 140 ft.
163	do.	do.		do.	495	12	do.	35	115	
164	14 Brady Ave., in Atlanta.	Armour & Co.	Hamilton & Sullivan	do.	500	8	do.		75	

RECORDS OF WELLS IN FULTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
165	Virginia Pl., NE., in Atlanta.	Peachtree Hills Apts.	Va. Supply & Well Co.	Drilled	400	8	Injection complex	40	27	
166	2700 Pinetree Rd., NE., in Atlanta.	J. T. Flack	do.	do.	265	6	do.	82	32	Upland slope.
167	Ben Hill.	Southern National Gas Co.	do.	do.	95	8	Granite		144	Lowland.
168	do.	do.	do.	do.	318	8	do.		25	Lowland slope.
169	do.	do.	do.	do.	500	8	do.		5	Upland slope.
170	3447 Peachtree Rd., in Atlanta.	Peachtree Rd. Apts.	Helms	do.	250	6	Injection complex		6	Abandoned.
171	2175 Gordon St., SW., in Atlanta.	J. P. Russell & Sons.	do.	do.	115	6	do.	40	17	
172	1953 Gordon Rd., SW., in Atlanta.	S. Truscott	O. V. Helms	do.	100	6	do.	15	15	
173	Sandy Springs	Burdette	J. A. Wood	do.	138	6	do.	35	30	Hilltop.
174	do.	J. J. Cochran	do.	do.	138	6	do.	30	50	do.
175	do.	R. N. Hardeman	do.	do.	142	6	do.	42	5	do.
176	94 Johnson Ferry Rd.	M. K. Cowart	do.	do.	90	6	do.	40	5	
177	do.	W. A. Adams	do.	do.	150	6	do.	40	15	
178	5400 Long Island Dr.	J. B. Childs	do.	do.	90	6	do.		16	
179	Carpenter Drive	H. J. Jameson	do.	do.	67	6	do.	8	15	Lowland.
180	Hildebrand Ave.	R. E. Harkrider	do.	do.	460	6	do.	80	2½	Hilltop.
181	0.8 mi. E. of Hwy. 9, about 2 mi. S. of Sandy Springs.	S. W. Mangham	do.	do.	98	6	do.	15	60	Lowland.
182	Riverview Rd.	P. K. Sanders	do.	do.	104	6	do.	70	30	Upland slope.

RECORDS OF WELLS IN FULTON COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
183	Powers Ferry Rd.	J. W. Chesseman	J. A. Wood	Drilled	72	6	Injection complex	20	15	
184	About 1 mi. S. of Hwy. 3-E, 0.2 mi. E. of Chattahoochee River.	Rhodes Perdue	Hamilton & Sullivan	do.	600	6			5	
185	1935 Mt. Paran Rd., NW., in Atlanta.	Frank North	J. L. Helms	do.	154	4	Granite		10	Hilltop. Analysis.
186	5425 Glenridge Dr., NW., in Atlanta.	J. W. Wooding		Dug	100					Analysis.
187	1401 Moores Mill Rd., in Atlanta.	Mrs. J. A. Smith		Drilled	150					do.
188	3381 Piedmont Rd., in Atlanta.	C. V. Logan	Va. Supply & Well Co.	do.	323	6	Granite		31	
189	670 Mt. Paran Rd., NW., in Atlanta.	Lowell Dowdell	do.	do.	165	6	Injection complex	60	35	Pumping level 125 ft. below surface.
190	Delowe Dr., SW., in Atlanta	M. A. Hornsby, Jr.	Va. Supply & Well Co.	Drilled	152	6	do.	30	8	Pumping level 120 ft. below surface.
191	Spalding Dr. at Mt. Vernon Rd., in Atlanta.	J. T. Whitner	do.	do.	403	6	do.	120	12	
192	721 Spring St., NW., in Atlanta.	Mrs. Frances Taylor	do.	do.	120	6	do.		½	
193	1 mi. E. of Sandy Springs.	T. K. Glenn	Hamilton & Sullivan	do.	1500	10	Granite	75	7	
194	5215 Peachtree Dunwoody Rd., in Atlanta.	W. J. Davis	Wood	do.	201	6	Brevard schist		20	
195	4825 Peachtree-Dunwoody Rd., in Atlanta.	George West		Dug	55	60	do.		15	
196	5266 Peachtree-Dunwoody Rd., in Atlanta.	L. E. Campbell	Wood	Drilled	134	6	do.		12	

RECORDS OF SPRINGS IN FULTON COUNTY

	Location	Owner	Name	Source rock	Yield (gallons per minute)	Remarks
A	Intersection of Cascade and Fairburn Roads, 3 miles west of Atlanta.		Utoy Springs	Hornblende gneiss	1	Lowland. Analysis. Abandoned.
B	Camp Grounds, ¼ mile north of Ben Hill.	Mt. Gilead Church Association	Camp Ground Spring	Granite	2½	Analysis.
C	247 Courtland St., in Atlanta.	Atlantic Ice & Coal Co.		Injection complex	35	Temp. 64° F. Used for air conditioning.
D	Ponce de Leon Park, near intersection of Ponce de Leon and Lullwater Road, in Atlanta.	City of Atlanta	Ponce de Leon Spring	Biotite gneiss	1	Analysis.
E	Hightower Rd., south of Gordon Rd., in Atlanta.		West-haven Spring	Granite	10	Temp. 59° F. Analysis.

ANALYSES OF WATER FROM FULTON COUNTY

(Parts per million. Numbers at heads of columns correspond to numbers in tables of wells and spring data. Analytical work by L. H. Turner, in Georgia Geological Survey Laboratory; and by A. T. Ness, in Water Resources Laboratory, U. S. Geological Survey.)

Number	3	4	12	13	14	42	44	45
Silica (SiO_2)	30	22	29	11	27	8	34	34
Iron (Fe)	0.05	0.02	2.0	0.16	0.41	0.25	0.04	0.05
Calcium (Ca)	13	15	71	29	14	36	13	20
Magnesium (Mg)	2.9	2.2	20	7.3	3.4	7	5.8	3.2
Sodium (Na)	8.2	7.7	20	7.2	7.4	Trace	7.6	11
Potassium (K)	2.3	2.3	5.4	2.6	3.0	Trace	5.3	22
Bicarbonate (HCO_3)	55	56	66	9.0	40	59	80	93
Sulfate (SO_4)	14	14	239	84	23	28	9.3	10
Chloride (Cl)	2.5	2.9	4.0	12	8.8	31	2.5	1.8
Fluoride (F)	0	0	0.1	0	0	....	0	0.1
Nitrate (NO_3)	0	1.2	0	9	0	0	0.08	0
Total dissolved solids	104	98	449	191	107	390	115	128
Total hardness as $CaCO_3$	44	47	260	102	49	119	56	63
Date of collection	Sept. 12, 1938	Sept. 12, 1938	Sept. 12, 1938	Sept. 12, 1938	Sept. 12, 1938	Dec. 12, 1947	May 2, 1938	May 2, 1938
Analyst	Ness	Ness	Ness	Ness	Ness	Turner	Ness	Ness

Number	61	72	78	111	136	138	164	172
Silica (SiO_2)	39	22	20	20	20	20	21	23
Iron (Fe)	6.8	0.5	0.3	0.8	0.4	0.25	0.15	0.15
Calcium (Ca)	25	31	50	42	47	28	41	26
Magnesium (Mg)	2	23	15	7	28	5	24	20
Sodium (Na)	....	Trace	Trace	Trace	33	Trace	Trace	Trace
Potassium (K)	....	Trace	Trace	Trace	0	Trace	Trace	Trace
Bicarbonate (HCO_3)	....	112	110	98	117	56	73	92
Sulfate (SO_4)	....	19	43	28	54	26	47	9
Chloride (Cl)	7.0	7	45	26	18	12	42	5
Fluoride (F)	....	0	0	0	0	0	0	0
Nitrate (NO_3)	....	0	0	0	0	0	0	0
Total dissolved solids	....	120	340	240	298	160	320	130
Total hardness as $CaCO_3$	....	103	187	135	230	90	200	147
Date of collection	Aug. 1, 1940	Mar. 5, 1948	July 5, 1945	Dec. 4, 1947	Mar. 5, 1948	Mar. 5, 1948	Mar. 5, 1948	Mar. 5, 1948
Analyst	Adair	Turner	Turner	Turner	Turner	Turner	Turner	Turner

Number	185	186	187
Silica (SiO_2)	24	10	17
Iron (Fe)	0.15	Trace	0.55
Calcium (Ca)	0	Trace	11
Magnesium (Mg)	0	8	7
Sodium (Na)	Trace	....	Trace
Potassium (K)	Trace	....	Trace
Bicarbonate (HCO_3)	....	....	73
Sulfate (SO_4)	0	0	3
Chloride (Cl)	6	4	3
Fuloride (F)	....	....	0
Nitrate (NO_3)	....	....	....
Total dissolved solids	69	24	84
Total hardness as $CaCO_3$	....	....	45
Date of Collection	July 5, 1945	Mar. 5, 1948	Mar. 5, 1948
Analyst	Turner	Turner	Turner

ANALYSES OF WATER FROM FULTON COUNTY—Continued

Number	A	B	C	D	E
Silica (SiO_2)	30	15	20	30	17
Iron (Fe)	0.10	0.15	0.2	....	0.2
Calcium (Ca)	23	8	28	4.9	Trace
Magnesium (Mg)	12	11	24	2.8	Trace
Sodium (Na)	10	Trace	Trace	3.5	Trace
Potassium (K)	Trace	Trace	Trace	....	Trace
Bicarbonate (HCO_3)	122	34	39	....	15
Sulphate (SO_4)	4	0	21	....	Trace
Chloride (Cl)	5	4	31	6.3	4
Fluoride (F)	....	0	0	....	0
pH	8.75	6.8	6.6	....	6.45
Nitrate (NO_3)	....	0	0	....	0
Total dissolved solids	260	85	225	....	118
Total hardness as $CaCO_3$	107	66	139	78	22
Date of collection	Jan. 23, 1948	Jan. 22, 1948	Mar. 5, 1948	1911	Mar. 4, 1948
Analyst	Turner	Turner	Turner	Everhart	Turner

Gwinnett County

According to the 1940 census Gwinnett County had a total population of 29,087. Lawrenceville, the largest town and the county seat, had a population of 2,223. Other urban centers within the county are Buford, Duluth, Suwanee, Norcross, and Dacula. Although agriculture is the chief activity, the manufacture of leather goods, textiles, and wood and metal products provides considerable employment and revenue.

PHYSIOGRAPHY

Like the others included in the Atlanta area, Gwinnett County forms a part of the Piedmont Upland. Its surface shows only moderate relief, no prominent hills standing out anywhere above the general surface of the plain. Drainage is principally southeastward across the county to the Ocmulgee River system. The Chattahoochee River is the western boundary of the county. Some of the principal streams draining the county are Yellow and Alcovy Rivers and Suwanee and Sweetwater Creeks.

GEOLOGY

The rocks of the biotite gneiss and schist series are prominently developed in the southwestern part of the county but elsewhere do not form extensive areas of country rock. This rock complex, where present, is composed chiefly of interbedded mica schist, sheets of hornblendic rocks, and granite. The prevailing dip is southeastward and averages about 40°.

Rocks of the Brevard schist extend northeastward through the county connecting the towns of Duluth, Suwanee, and Buford. A thinner, parallel belt is shown on the geologic map as passing through Dacula. Beds of quartz-mica schist, hornblende schist, micaceous quartzite, and graphitic schist compose this formation in the county. These rocks give evidence of much shearing and it appears that the belt is involved in a major low-angle thrust from the southeast. This overthrust appears to have overridden the rocks in the central part of the county, bringing up the formerly deep seated granite rocks to the surface. Subsequent erosion probably accounts for the scarcity of the biotite gneiss and schist in the southern part of the county. The granite appears to become more gneissic and metamorphosed from the southeast corner of the county toward the northwest near Lawrenceville, without apparent change in the major rock type.

GROUND WATER

The rocks of the biotite gneiss and schist series in the southwestern part of the county are considered to be potentially good producers of ground water. Because hornblendic rocks are intermingled throughout this complex, water from these rocks would doubtless be more highly mineralized than that from other rocks in the county.

The rocks of the Brevard schist belt, which is in the northern part of the county and is delineated by the towns of Norcross, Duluth, and Buford, are relatively poor sources of ground water. However, wells penetrating beds of micaceous quartzite might yield large supplies of water of low mineral content. Also, one or more apparently discontinuous beds of crystalline limestone, which probably would yield relatively large amounts of water, occur within the belt. The limestone is exposed in the Brevard schist a few miles northwest of Buford, in Hall County, but outcrops in Gwinnett County have not been observed. It is likely that the beds of graphitic schist in the belt grade into limestone at depth. Owing to the extensive shearing and accompanying low-angle overthrust faulting, the schistose rocks are so compact that little water can circulate through them except where special structural features exist.

Because the part of the county southeast of Lawrenceville is largely agricultural, only small amounts of ground water have been required at any one locality. Consequently, as regards ground-water supplies, this area is relatively undeveloped. However, the extensive granite mass underlying this area is thought to be favorable for the storage and circulation of water along the lower slopes, where water is continuously available for recharge. Rapid runoff of rain water from the surfaces of the hills prevents much influent seepage into the rocks underlying them and, consequently, they are poor producers of ground water. The quality of ground water in this area, as in most granite areas, should be good for most purposes.

MUNICIPAL SUPPLIES

Lawrenceville (population 2,223).—The municipal water supply of Lawrenceville is derived from two deep wells. Water from these wells is chlorinated and pumped to an elevated steel reservoir, from which it is distributed by gravity. Because these two wells have greater yields than any others in the entire Georgia Piedmont, a brief history of them is considered worthwhile.

The original yield of one well in 1945 was about 470 gallons per minute, but it declined to less than 200 gallons per minute by 1947. The other well, drilled in 1947, yields approximately 400 gallons per minute. Both wells penetrated the same belt of hornblendic rocks, which dip to the southeast at an angle of approximately 35°. The possibility that the water is derived from beneath a fault block overthrust at a low angle from the southeast, in which the subjacent beds were crushed and turned concave upward (dragged) to form a zone of large and numerous openings in the rocks, is suggested by the ease with which the water-bearing zone was drilled and by the fact that overthrusting is a common structural feature of the area. Wells located northwest or southeast of the belt of hornblendic rocks cannot be expected to yield such a bountiful supply. Although the over-all quality of the water is good, it may be too mineralized for certain industrial uses.

Buford (population 4,191).—The municipal water supply of Buford is derived from Big Creek. Treatment of the raw water prior to distribution consists of sedimentation, coagulation with alum and lime, sedimentation, filtration, and chlorination. The capacity of this plant is estimated to be slightly in excess of 500,000 gallons a day.

Norcross (population 979).—Norcross derives its municipal water supply from one well from which approximately 100,000 gallons per day is pumped. Treatment of water from this well includes aeration, sedimentation, filtration, and chlorination.

Duluth (population 626).—The town of Duluth depends upon two deep wells for its municipal water supply. The aggregate yield from these two wells is approximately 40 gallons per minute. Water is chlorinated at the wells, from which it is pumped to an elevated steel reservoir and distributed by gravity.

RECORDS OF WELLS IN GWINNETT COUNTY

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
1	About 0.2 mi. N. of Hwy. 29, E. side of town, in Lawrenceville.	City of Lawrenceville		Drilled	386	8	Hornblende gneiss	20	270	Rolling topography.
2	100 ft. S. of Seaboard R. R., at Ice plant, in Lawrenceville.	Lawrenceville Ice & Coal Co.	Helms	do.	217	6	do.	55	20	Near base of upland slope. Analysis.
3	About 50 ft. W. of filter plant, in Norcross.	City of Norcross		do.	342	8	do.	80	100	Near top of ridge.
4	N. side Hwy. 29, about 4 mi. W. of Lawrenceville.	Gwinnett County, (Bethseda School)	Va. Supply & Well Co.	do.	270	6	Injection complex	31	50	Hilltop. Analysis.
5	About 4 mi. S. of Lawrenceville, in Grayson.	Gwinnett County (Grayson School)	Ragan Plumbing Co.	do.	300	6	Granite gneiss	22	50	Gentle slope.
6	1 mi. S. of Dacula, near crossroads.	W. T. Hinton	Va. Supply & Well Co.	do.	375	6	do.	125	1	Hilltop.
7	1 mi. S. of Dacula, near well 6.	Jim Hinton	do.	do.	150	6	do.	60	1	do.
8	3 mi. S. of Dacula, in Harbin.	Gwinnett County (Harbin School)		do.	95	6	do.		10	Upland slope.
9	0.2 mi. N. of Hwy. 29, near well 1, in Lawrenceville.	City of Lawrenceville	Va. Supply & Well Co.	do.	302	10	Hornblende gneiss	93	471	Rolling topography. Analysis.
10	W. side Hwy. 20, ½ mi. N. of Southern R. R., in Buford.	Gwinnett County (Sugar Hill School)	do.	do.	349	6	do.	65	30	Hilltop.
11	E. side Hwy. 20, 2 mi. S. of Buford.	Gunter's Dairy	do.	do.	300	6	Mica schist	60	5	Top of high hill. Analysis.
12	About 100 ft. S. of Seaboard R. R., N. side of town, in Lawrenceville.	City of Lawrenceville	do.	do.	352	8	Hornblende gneiss	14.7	400	Lowland. Analysis.
13	4½ mi. SE. of Lawrenceville E. side of dirt road.	James W. Moore	do.	do.	110	6	Granite	35.2	15	Hilltop. Analysis.

RECORDS OF WELLS IN GWINNETT COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
14	About 400 ft. N. of Seaboard R. R., in Dacula.	Town of Dacula		Drilled	375	8	Granite	6.3	20	Lowland. Analysis.
15	0.1 mi. S. Hwy. 78, in Snellville.	Snellville Community Canning Plant	Ragan Plumbing Co.	do.	342	6	do.	45	16	Upland ridge. Analysis.
16	0.2 mi. N. of Southern R. R., in Duluth.	Calvin Parsons	Ragan Plumbing Co.	do.	145	6	Mica schist	30		Hilltop.
17	Few hundred yds. N. of Southern R. R., W. side Main St., in Duluth.	Gwinnett County (Duluth School)	do.	do.	220	8	do.		18	do.
18	Between Hwy. 23 and Southern R. R., in center of town in Duluth.	Town of Duluth	Georgia Well Drilling Co.	do.	300	8	do.	12	18	Depression in top of upland ridge.
19	E. side Hwy. 23, 1½ mi. SW. of Duluth.	H. S. McCurry	Ragan Plumbing Co.	do.	225	6	do.		25	Near top of ridge.
20	Near well 3, in Norcross.	City of Norcross	Va. Supply & Well Co.	do.	385	8	Hornblende	79	102	Near top of ridge. Pumping level 200 ft. below surface.
21	1¼ mi. E. of Norcross.	D. J. Bowen	Va. Supply & Well Co.	do.	252	6	Granite	55	2.4	Upland slope.
22	S. side Hwy. 23, in Norcross.	Frank Knight	do.	do.	380	6	do.	15	55	do.
23	1½ mi. S. of Norcross on dirt road.	A. H. Rumbold	Ragan Plumbing Co.	do.	404	6	Granite gneiss		4	Upland plain.

RECORD OF SPRING IN GWINNETT COUNTY

Location	Owner	Name	Source rock	Yield (gallons per minute)	Remarks
A 2 miles north of Duluth.		Verner Springs.	Brevard schist	25	Analysis.

ANALYSES OF WATER FROM GWINNETT COUNTY

(Parts per million. Numbers at heads of columns correspond to numbers in tables of wells and spring data. Except for No. 12, analytical work by Edgar Everhart and L. H. Turner, in Georgia Geological Survey Laboratory.)

Number	2	4	9	11	12	13	14	15	A
Silica (SiO_2)	19	18	14	14	22	5	16	12	14
Iron (Fe)	0.40	0.15	0.35	0.25	0.3	0.15	0.50	0.10	......
Calcium (Ca)	27	11	22	Trace	18	Trace	7	Trace	21
Magnesium (Mg)	14	......	8	Trace	3.4	14	Trace	5	1.3
Sodium (Na)	128	Trace	Trace	0	......	0	Trace	Trace	3
Potassium (K)	......	Trace	Trace	0	......	0	Trace	Trace	1.1
Bicarbonate (HCO_3)	88	74	66	51	......	37	15	11	2
Sulfate (SO_4)	15	6	21	Trace	8.8	5	Trace	0	......
Chloride (Cl)	100	1.5	6	3	4.8	4	6	6	3.9
Fluoride (F)	0	0	0	......	......	0	0	0	......
pH	7.1	6.3	6.4	6.8	6.9	6.5	6.2	6.15	......
Nitrate (NO_3)	0	0	0	0	......	0	0	0	......
Total dissolved solids	265	178	128	33	112	75	65	50	85
Total hardness as $CaCO_3$	126	28	88	21	58	58	18	21	......
Date of collection	Jan. 22, 1948	Jan. 22, 1948	Apr. 29, 1947	Jan. 22, 1948	Oct. 17, 1947	Jan. 22, 1948	Jan. 22, 1948	Jan. 22, 1948	1911
Analyst	Turner	Turner	Turner	Turner	Law & Co.	Turner	Turner	Turner	

Rockdale County

In 1940 Rockdale County had a population of 7,724. Conyers and Milstead are the only towns in the county. Agriculture and the manufacture of textiles and wood products constitute the chief sources of revenue in the county.

PHYSIOGRAPHY

Rockdale County is distinctly hilly and represents a typical section of the Piedmont belt of Georgia. Both Yellow River in the north and South River along the southern border flow southeastward and form the major drainage of the county. The streams are actively engaged in dissecting the upland; however, in the granite area in the northern part of the county the lower, moisture-laden parts of the rock near the streams weather and erode more rapidly than the higher and drier rock, and the interstream areas have not been greatly dissected so far. There are no pronounced ridges in the county.

GEOLOGY

The part of the county south of Conyers is underlain by rocks of the biotite gneiss and schist series. Rapid weathering has left a deep residual zone mantling the rocks so that their identity is not always certain. Micasillimanite schist is prevalent 2 miles southeast of Conyers, and there the fibrous sillimanite is considerably altered into sericite and quartz. Other component rocks of the series are biotite gneiss, irregular masses of granite, and sheets of hornblende rocks.

The greater part of the county north of Conyers is underlain by massive granite of the Lithonia type. The granite shows contorted gneissic banding, and fresh exposures in which the banding is flat lying are common in the upland. The subordinate bodies of schist and gneiss in this area are regarded as roof pendants on this underlying granite batholith that are gradually being eroded away.

GROUND WATER

No large-scale development of ground-water supplies has been undertaken in Rockdale County, and, consequently, their potentialities are not fully known. The rural area south of

Conyers relies almost entirely on dug wells, most of which are less than 50 feet deep and penetrate weathered rock material which is the source of the water. The average yield of the dug wells is approximately 2 gallons per minute. The extensive belt of biotite gneiss and schist in the southern part of the county contains enough fractures and schistose planes to provide fairly good water supplies.

The granite area north of Conyers appears to contain a relatively large amount of ground water in the lowland areas and poor supplies on the hilltops. Most of the hills are bald exposures of fresh granite from which rain water runs off readily, so that there is little seepage into the fractures.

Conyers (population 1,619).—Two wells 500 feet deep furnish the municipal water supply of Conyers, the county seat. Both wells penetrate granite below schist, but whether the supply is derived from the granite or from the small remnants of schist left on top of the granite batholith is not known. In 1943, one well yielded 110 gallons per minute when pumped continuously; the other produced 45 gallons per minute under similar conditions. According to report, by 1943 the more productive well had yielded more than 100,000 gallons of water per day for 11 years; apparently it is one of the best wells in the Atlanta area. Water from these wells is chlorinated, pumped to an elevated steel reservoir, and distributed by gravity.

Milstead (population 780).—Two deep wells and a spring, having an aggregate yield of 100 gallons per minute, supply this industrial village with water. All water is chlorinated prior to distribution throughout the mill area. Granite of the Lithonia type is the only rock in this area; it is freshly exposed at the site of one of the wells on a hill; that well yields approximately 20 gallons per minute. The other well, which yields 60 gallons per minute, and the spring are located near each other on a lowland slope, where water-laden openings along exfoliation planes are the major openings in the rock. Because of their favorable location both the well and the spring have good yields.

RECORDS OF WELLS IN ROCKDALE COUNTY

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
1	W. side elevated steel water tank, near school, in Conyers.	Town of Conyers	Va. Supply & Well Co.	Drilled	500	8	Granite	113	120	Hilltop. Pump bowls set at 177 ft. Pumped 100,000 gallons per day for 11 years.
2	0.6 mi. E. of Ga. R. R. Sta., 100 ft. N. of R. R. at pumping plant, in Conyers	do.	do.	do.	350	8	do.	160	90	On hill slope. Temp. 63° F.
3	About 2½ mi. SW. of Conyers.	Rockdale County (Smyrna School)		Dug	38.2	36	Injection complex	30.1	3	Top of upland slope.
4	About 2½ mi. E. of Rockdale-DeKalb Co. line, 4 mi. SW. of Conyers.	Cleeve Morrison	Murphey (?)	Drilled	116		do.		28	Near top of upland ridge.
5	1 mi. E. of Rockdale-DeKalb Co. line, 4½ mi. SW. of Conyers.	Presbyterian Home Mission	Gray (?)	do.	340	6	do.		20	Top of upland ridge.
6	0.2 mi. E. of Rockdale-DeKalb Co. line, 5 mi. SW. of Conyers.	W. E. Shepherd	O. V. Helms	do.	500		do.		30	Near top of upland ridge.
7	2 mi. NW. of Rockdale-Newton Co. line, 6 mi. S. of Conyers.	W. H. Reed	Massey (?)	do.	517	6	do.	100	20	Top of high hill.
8	3½ mi. NW. of Rockdale-Newton Co. line, 6 mi. SW. of Conyers.	M. J. Harbin		do.	180	6	do.		18	Upland slope.
9	S. side Hwy. 12, 2 mi. E. of Conyers.	N. H. Thacker	J. L. Helms	do.	143	6	do.	18	4	Upland ridge.
10	E. side Hwy. 20, at Mill, in Milstead.	Callaway Mills		do.	600	10	Granite	55	20	Upland slope. Pump bowls set at 215 ft.
11	do.	do.		do.	550	10	do.	25	60	Lowland slope. Pump set at 115 ft.

RECORDS OF WELLS IN ROCKDALE COUNTY—Continued

Well number	Location	Owner	Driller	Type of Well	Depth (feet)	Diameter (inches)	Rock penetrated	Depth to Water Level (feet)	Yield (gallons per minute)	Remarks
12	2½ mi. E. of Rockdale-DeKalb Co. line, 4 mi. SW. of Conyers.	Cleeve Morris	Va. Supply & Well Co.	do.	200	6	Granite	50	7	Near top of upland ridge.
13	1 mi. E. of Rockdale-DeKalb Co. line, 4½ mi. SW. of Conyers.	Monastery of the Holy Ghost	do.	do.	621	8	Injection complex	90	4	Top of upland ridge.
14	do.	do.	do.	do.	307	8	do.			do.

RECORD OF SPRING IN ROCKDALE COUNTY

	Location	Owner	Name	Source rock	Yield (gallons per minute)	Remarks
A	600 feet east of Yellow River and ½ mile north of Hwy. 138.	P. A. Sims		Granite	3	Analysis.

ANALYSES OF WATER FROM ROCKDALE COUNTY

(Parts per million. Numbers at heads of columns correspond to numbers in tables of wells and spring data. Analytical work by L. H. Turner, in Georgia Geological Survey Laboratory.)

Number	1	11	A
Silica (SiO_2)	26	20	....
Iron (Fe)	Trace	0.15	....
Calcium (Ca)	22	19	Trace
Magnesium (Mg)	10	9	Trace
Sodium (Na)	10	7	....
Potassium (K)	....	....	....
Bicarbonate (HCO_3)	59	49	....
Sulfate (SO_4)	11	12	0
Chloride (Cl)	3	9	3.5
Nitrate (NO_3)	0	0	0
Total dissolved solids	123	130	19
Fluoride (F)	0	0	....
pH	7.55	6.95	....
Date of collection	Mar. 31, 1948	Mar. 29, 1948	Apr. 22, 1947
Analyst	Turner	Turner	Turner

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GEOLOGIC MAP of the ATLANTA AREA

modified after Geologic Map of Georgia, Georgia Geological Survey, 1939

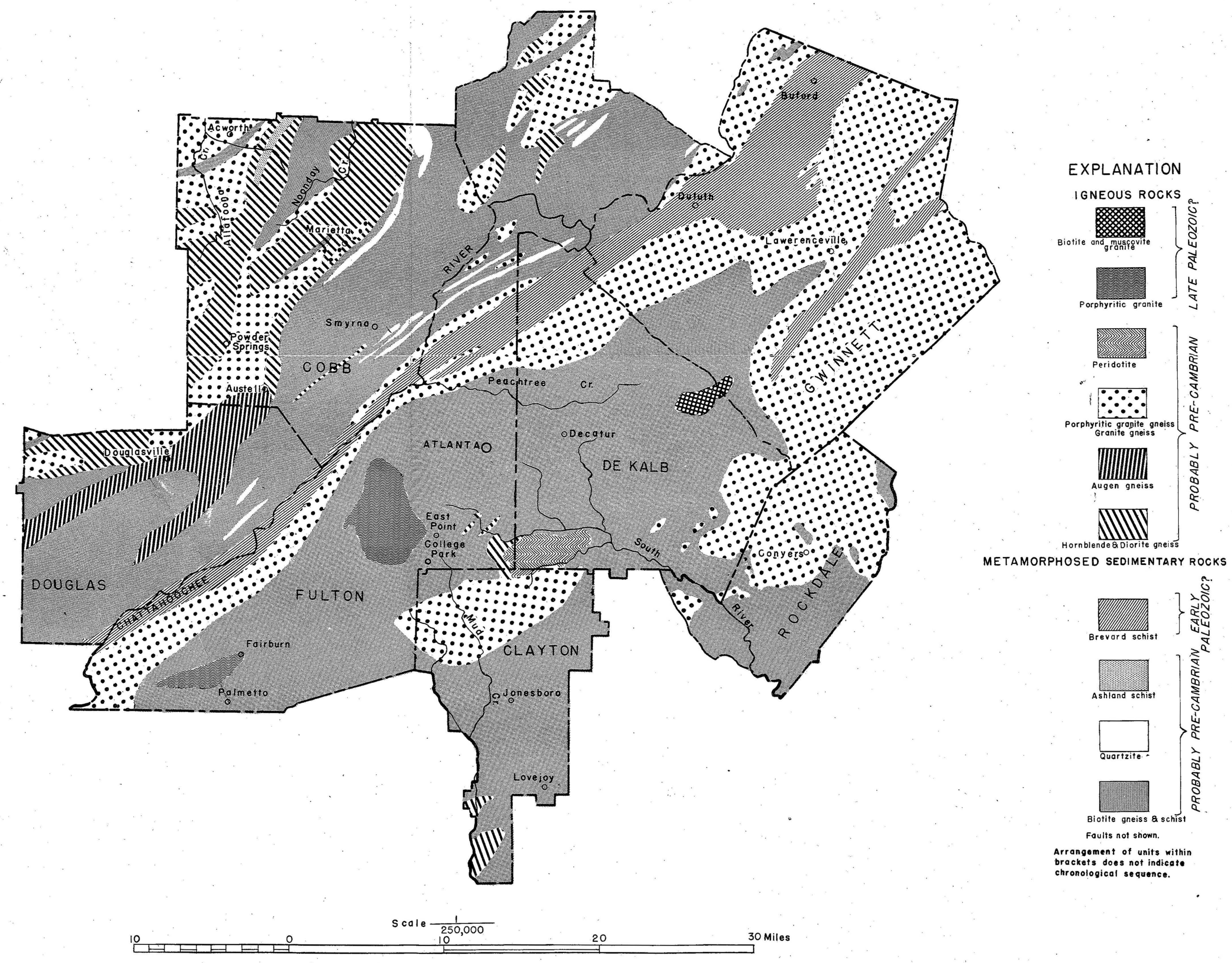
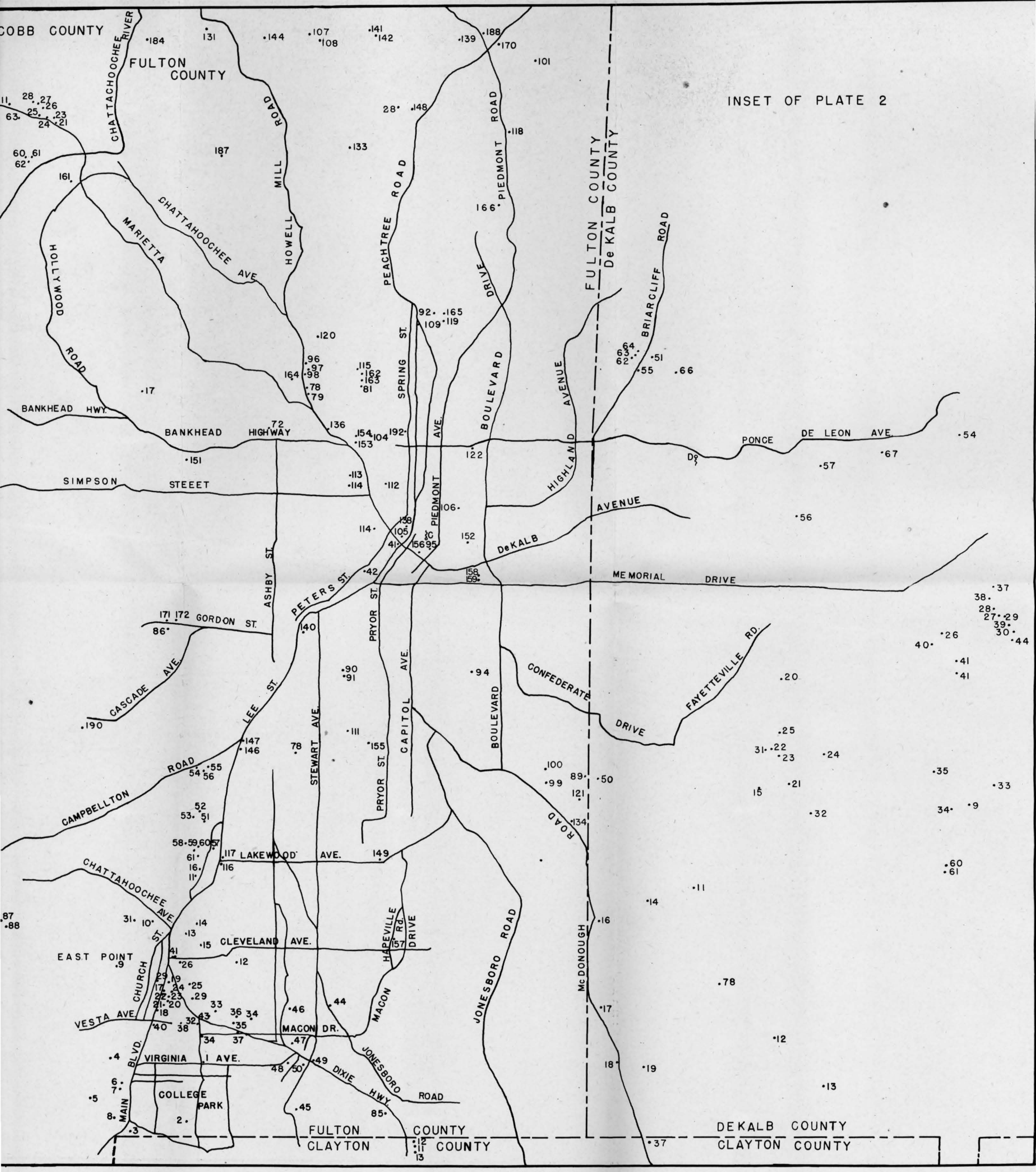


Plate 2

Map of the Atlanta area, Georgia, showing the location of wells and springs.


INSET OF PLATE 2
COBB COUNTY
FULTON COUNTY
CHATTAHOOCHEE RIVER
HOWELL MILL ROAD
PEACHTREE ROAD
PIEDMONT ROAD
FULTON COUNTY
De KALB COUNTY
BRIARCLIFF ROAD
CHATTAHOOCHEE AVE
MARIETTA
HOLLYWOOD ROAD
BANKHEAD HWY.
BANKHEAD HIGHWAY
SPRING ST.
AVE.
DRIVE
BOULEVARD
HIGHLAND AVENUE
PONCE DE LEON AVE.
SIMPSON STEEET
PIEDMONT
DeKALB AVENUE
MEMORIAL DRIVE
ASHBY ST.
PETERS ST.
PRYOR ST.
GORDON ST.
CASCADE AVE.
LEE ST.
CAPITOL AVE.
CONFEDERATE DRIVE
FAYETTEVILLE RD.
STEWART AVE.
PRYOR ST.
BOULEVARD
CAMPBELLTON ROAD
ROAD
LAKEWOOD AVE.
CHATTAHOOCHEE AVE
CHURCH ST.
EAST POINT
CLEVELAND AVE.
HAPEVILLE Rd.
DRIVE
JONESBORO ROAD
McDONOUGH
MACON
VESTA AVE.
MACON DR.
VIRGINIA AVE.
MAIN BLVD.
COLLEGE PARK
DIXIE HWY.
JONESBORO ROAD
FULTON COUNTY
CLAYTON COUNTY
DEKALB COUNTY
CLAYTON COUNTY