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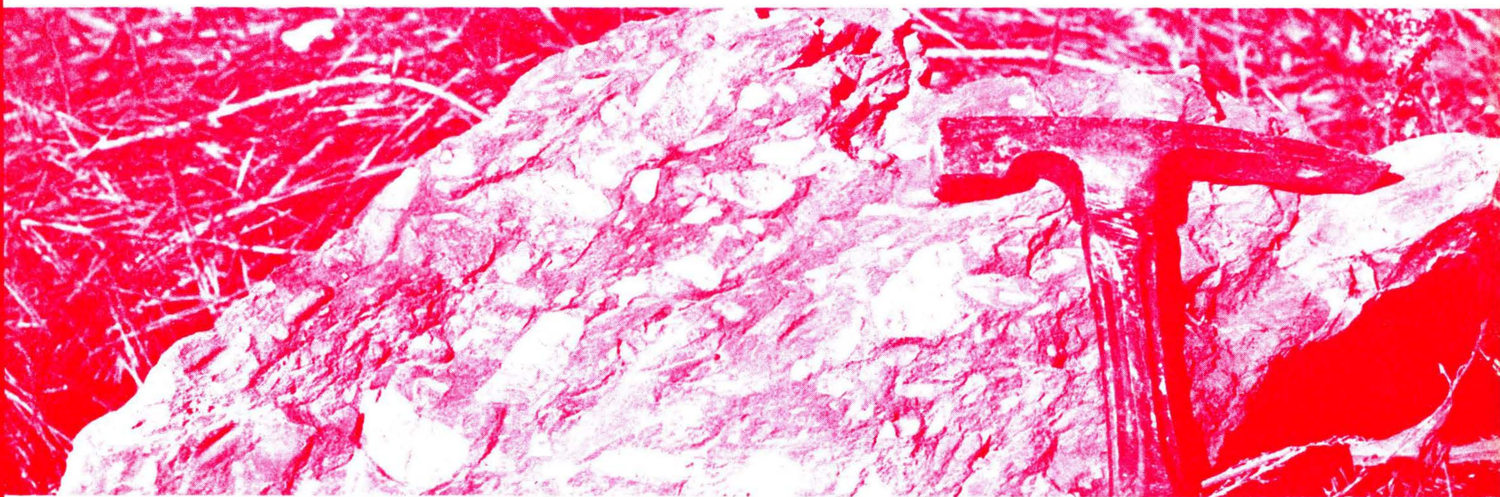
GEOLOGY AND GROUND-WATER RESOURCES OF FLOYD AND POLK COUNTIES, GEORGIA

by

Charles W. Cressler



THE GEOLOGICAL SURVEY OF GEORGIA
DEPARTMENT OF MINES, MINING AND GEOLOGY

Jesse H. Auvil, Jr.
State Geologist and Director

ATLANTA

1970

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THE GEOLOGICAL SURVEY OF GEORGIA
DEPARTMENT OF MINES, MINING AND GEOLOGY
PREPARED IN COOPERATION WITH THE U. S. GEOLOGICAL SURVEY

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GEOLOGY AND GROUND-WATER RESOURCES OF FLOYD AND POLK COUNTIES, GEORGIA

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Charles W. Cressler
U. S. Geological Survey

ABSTRACT

Floyd and Polk Counties are mainly in the Valley and Ridge province of Georgia but extend a short way into the Piedmont province. They are underlain by formations ranging in age from Early Cambrian to Pennsylvanian.

Over most of the area, except on ridges and steep slopes, ground water is available from wells in sufficient quantities for domestic and farm supplies and the quality of the water generally is good. Wells yielding 600 to 1,500 gpm (gallons per minute) are found locally, and the water, although hard, is low in iron content and is suitable for many industrial needs.

Good quality spring water that is moderately hard to hard and has a low iron content discharges from several springs in amounts ranging from less than 0.5 mgd (million gallons per day) to nearly 15 mgd.

The Newala Limestone, of Early Ordovician age, is the most productive aquifer in the area. Seven springs that have a combined flow of more than 24 mgd discharge from it; and most of the wells in the area yield water from this formation.

Geologic mapping resulted in several significant changes, among them: The Rockmart Slate was reassigned from Mississippian age to Middle Ordovician; areas formerly mapped as Weisner Quartzite (Cambrian) were found to be underlain by Newala Limestone (Ordovician) and younger formations; and the iron in the important iron mining area of western Polk County was found to be in the residuum of the Newala Limestone rather than of the Shady Dolomite (Cambrian).

INTRODUCTION

Location and Extent of Area

Floyd and Polk Counties form one of the most important centers of business, industry, and agriculture in northwest Georgia (fig. 1). Among the wide variety of goods produced there are paper, cement, rayon, crushed rock, textiles, electricity, and electrical products. Floyd County, with a population of more than 69,000 (1960 census) ranks 12th in the State, and Polk County with over 28,000 people ranks 29th. Together the counties include 826 square miles.

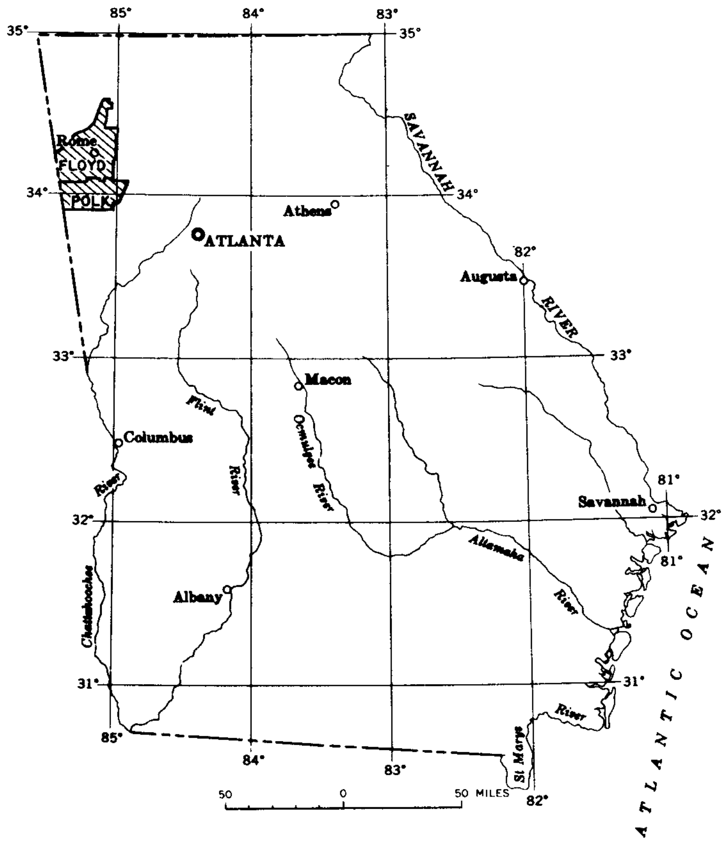

Figure 1. Index map of Georgia showing location of Floyd and Polk Counties.

Rome, the county seat of Floyd County and the largest city in the report area, is at the confluence of the Etowah, Oostanaula, and Coosa Rivers. It is connected by U. S. Highway 27 to Chattanooga, Tenn., 70 miles to the north, and to Cedartown, 15 miles to the south. U. S. Highways 411 and 41 give Rome access to Atlanta, some 70 miles away to the southeast.

Cedartown, the county seat of Polk County, is at the intersection of U. S. Highway 278, which connects it to Atlanta and to points west in Alabama, and U. S. Highway 27 which gives ready access to Floyd County on the north and Haralson County to the south.

The Counties are served by the Southern Railway, the Seaboard Coastline Railroad, and the Central of Georgia Railway.

Physiography, Topography, and Climate

Nearly all of Floyd and Polk Counties is in the Valley and Ridge physiographic province; only the southern and eastern edge of Polk County extends into the Piedmont physiographic province. Northwestern Floyd County, the most mountainous part of the study area, has a terrain of narrow valleys whose bottoms are between 600 and 700 feet above sea level, bordered by steep ridges whose tops range from 1,400 to 1,600 feet above sea level. The terrain in the remainder of Floyd County and in most of Polk County consists chiefly of lowlands and hilly areas that range in altitude from about 600 to 1,000 feet. A few isolated ridges occur there but most have altitudes less than 1,300 feet and only one, Indian Mountain in western Polk County, reaches 1,500 feet above sea level.

The part of Polk County lying in the Piedmont province is a moderately dissected plateau having rounded hilltops and narrow stream valleys. The plateau stands about 500 feet above the adjoining lowlands of the Valley and Ridge province and is separated from them by a fault-line scarp. In Polk County the plateau attains a maximum altitude of about 1,300 feet.

Floyd and Polk Counties have a mild climate. Their average January temperature is about 43° F. and their average July temperature is about 80° F. The average annual precipitation in the two counties is about 53 inches and includes only a small amount of snow.

Rainfall in this part of the State has two peaks, one in winter and one in midsummer, separated by periods of lighter rains in spring and autumn. Autumn is the driest season of the year. Large variations can occur in the amount of rainfall received from year to year, and amounts from the wettest years may be about double that for the driest years. Nearly half of the rainfall comes in amounts of 1 inch or more within 24 hours.

Dry spells occasionally cause heavy damage to crops and pastures and result in shortages in water supplies. Droughts of this severity are, however, usually limited to rather small areas so that any given locality, on the average, is not likely to have a serious drought more often than once in 10 to 15 years.

Purpose, Scope and Methods of Investigation

This investigation was made by the U. S. Geological Survey in cooperation with the Georgia Department of Mines, Mining and Geology, as part of a statewide appraisal of ground-water resources. The purpose of the investigation was to determine the amount and chemical quality of water available in Floyd and Polk Counties, and to describe and delineate the aquifers from which it comes. This study covers 2 of 10 counties in the Paleozoic rock area of Georgia; studies of Catoosa, Chattooga, and Walker Counties (Cressler, 1963, 1964) and of Dade and Bartow Counties (Croft, 1963, 1964) have been completed and the results already published.

In making this study, more than 700 wells were inventoried to learn the range in well depth, the depth to water, and the quality and quantity of the water being taken from the various aquifers. Periodic measurements were made on several wells to indicate the amount of seasonal fluctuation that occurs in the water table.

Springs of significant size were inventoried and their rate of flow measured or estimated. The temperature of the spring water was recorded, and the reliability, degree of fluctuation, and the quality of the water were ascertained where possible.

Water samples were taken from 8 wells and 16 springs for chemical analyses by the Quality of Water Laboratory, U. S. Geological Survey, Ocala, Florida.

To delineate the various aquifers and determine their lithologic character and their thickness, the geology of the counties was mapped using aerial photographs as a base. Fossils were used, wherever obtainable, to assure accurate age determinations and correlations. Fossil collections were identified by personnel of the Paleontology and Stratigraphy Branch of the U. S. Geological Survey and their identifications and assigned ages are included in this report.

Fossils found during the investigations revealed, unexpectedly, that some formations in the area had been incorrectly dated, that geologic structures had been misinterpreted, and that some formations had previously neither been recognized nor mapped. As solving these problems would require more time than was alloted the project, an extension was arranged to allow for more geologic mapping. Because of the resulting new information and interpretations, the larger part of this report is devoted to geology.

Well and Spring Numbering System

Wells in this report are numbered according to a system based on the 7½-minute topographic quadrangle maps of the U. S. Geological Survey. Each 7½-minute quadrangle in the State has been given a number and a letter designation according to its location. The numbers begin in the southwest corner of the State and increase numerically eastward. The letters begin in the same place, but progress alphabetically to the north, following the rule of "read right up." Because the alphabet contains fewer letters than there are quadrangles, those in the northern part of the State have double letter designations, as in 5HH.

Floyd and Polk Counties are covered by all or part of 23 quadrangles (figs. 4 and 5). Wells in each are numbered consecutively, beginning with number one as in 5HH1. Springs in each quadrangle are numbered similarly except that the letter "S" is added to distinguish them from wells, as in 5HHS1.

Previous Investigations

The general geology of the area was discussed in early reports by Smith (1890), Hayes (1891, 1892, 1894, and 1902) and Spencer (1893). The most recent publication dealing with the general geology was by Butts and Gildersleeve (1948). Several reports dealing with specific aspects of the geology and mineral resources of the area have been published as bulletins of the Georgia Geological Survey; a list of those available can be obtained from the Georgia Department of Mines, Mining and Geology, 19 Hunter Street, S. W., Atlanta, Georgia 30334. Other detailed work has been done by graduate students of Emory University for Masters theses.

Acknowledgments

The writer expresses his appreciation to the citizens of Floyd and Polk Counties for their cooperation in furnishing information for the well and spring inventory, and for their aid in collecting water samples for chemical analyses.

Acknowledgment is due the many persons who contributed in various ways to the investigation. Drs. Arthur T. Allen and R. J. Martin of the Emory University Geology Department contributed greatly to working out the structure of Turkey Mountain. Mr. Ernest W. Renshaw, geologist with American Cyanamid Company, offered many helpful suggestions, particularly concerning the structure and stratigraphy of the Knox Group, and supplied data about ground-water conditions in the residuum of the Knox. Dr. Robert D. Bentley accompanied the writer in mapping and correlating the Talladega Slate from its type locality in Alabama into Polk County, and was very helpful in interpreting several geologic phenomena. Dr. A. S. Furcron, former Director, Georgia Department of Mines, Mining and Geology, discussed geolgoic problems with the writer and made available unpublished information he had obtained on the area.

The writer is especially indebted to Drs. Robert B. Neuman and Ellis L. Yochelson of the Paleontology and Stratigraphy Branch of the U. S. Geological Survey who came to the study area to collect fossils, and assist in working out the stratigraphy; and to Dr. John Rodgers of Yale University who visited the counties and offered valuable suggestions about the geologic interpretations. Special thanks are due Mr. Thomas J. Crawford who made visits to the Indian Mountain-Etna Valley area to show the writer mines, outcrops, and fossil localities and who generously made available his field notes on the area and the fossils

he collected during a study made for a Masters thesis.

Mr. Horace Sheffield and many other students from Shorter College in Rome, and Dr. Lewis Lipps, Professor of Geology at Shorter, collected and cataloged numerous fossils from Polk County. Mr. Allen Sheldon and Dr. Lipps were instrumental in bringing to the writer's attention the excellently preserved Middle Cambrian trilobites obtained from the banks of the Coosa River. Mr. Cyrus Pope was generous enough with his time to spend a day guiding the writer to dozens of iron mines in the rugged terrain around Indian Mountain.

Dr. William B. N. Berry of the University of California, Berkeley, identified the graptolites collected from Polk and Murray Counties, Ga.

Plates of fossils for the report were prepared by the Paleontology and Stratigraphy Branch of the U. S. Geological Survey under the direction of Dr. Ellis L. Yochelson.

This investigation was started under the direct supervision of H. B. Counts, former district engineer, Ground Water Branch, and completed under A. N. Cameron, district chief, Water Resources Division, Georgia District, U. S. Geological Survey.

Mr. Harry E. Blanchard, Hydraulic Engineering Technician, made the complete well inventory of Polk and Floyd Counties and collected water samples for chemical analyses.

GEOLOGIC FORMATIONS AND THEIR WATER-BEARING PROPERTIES

Floyd and Polk Counties are underlain by more than 20 geologic formations that have an aggregate thickness of several thousand feet; they range in age from Early Cambrian to Pennsylvanian. Originally the formations were horizontal, but compressional and tensional forces later warped them and broke them into a series of faulted folds. Erosion of the folded and faulted formations produced the varied outcrop pattern that exists today.

In order to appraise the ground-water resources of an area, it is necessary to know the lithology, thickness, and topographic setting of the geologic formations there. This information for Floyd and Polk Counties is summarized in table 1 and is discussed in more detail in the text that follows. The generalized availability of ground water in the counties is shown in figures 2 and 3. The detailed outcroppings of the formations and structural cross sections are given on the accompanying geologic maps, figures 4 and 5.

Cambrian System

Shady Dolomite

Along the trace of the Coosa fault between Rome and Cave Spring, the Rome Formation is underlain by a unit of dolomite that tentatively is being correlated with the Shady Dolomite of Early Cambrian age. The Shady, named by Keith (1903, p. 5) for Shady Valley, Johnson County, Tenn., normally occupies a position below the Rome, separating it from the Weisner Quartzite. As the dolomite in Floyd County occupies the same stratigraphic position and is of a similar character, it is being correlated with the Shady.

Lithology and thickness.—In Floyd County, on the north bank of Big Cedar Creek about 300 feet east of the bridge on Spout Springs Road (fig. 4), the exposed Shady consists of a lower 20-foot unit and an upper 10 to 15-foot unit of thinly to massively bedded, commonly shaly dolomite, separated by about 10 feet of dark shale and very thin bedded earthy dolomite that weathers to shale. The upper dolomite layer is succeeded by 5 feet of dark-gray shale that passes abruptly upward into maroon shale and siltstone of the Rome Formation.

The dolomite is mainly medium to dark gray, very thickly to massively bedded and fine grained. Much of it contains large amounts of silt and clay that either weathers out as shale or accumulates on the surface as an olive-gray, tan, or yellowish-brown crust. Where the dolomite is deeply leached, the impurities form a tan shale residuum. The residuum is well displayed in the first road cut southeast of the creek bridge.

In natural exposures the Shady is dotted by rounded to irregularly shaped pieces of highly fractured light-gray quartz that protrude from its surface, an occurrence not observed on any other formation. Much of the dolomite is crisscrossed by numerous fractures filled by light-gray quartz. Some outcrops are so highly fractured that about half of the rock consists of quartz fracture fillings. One outstanding feature of the Shady is the complete absence of bedded or nodular chert.

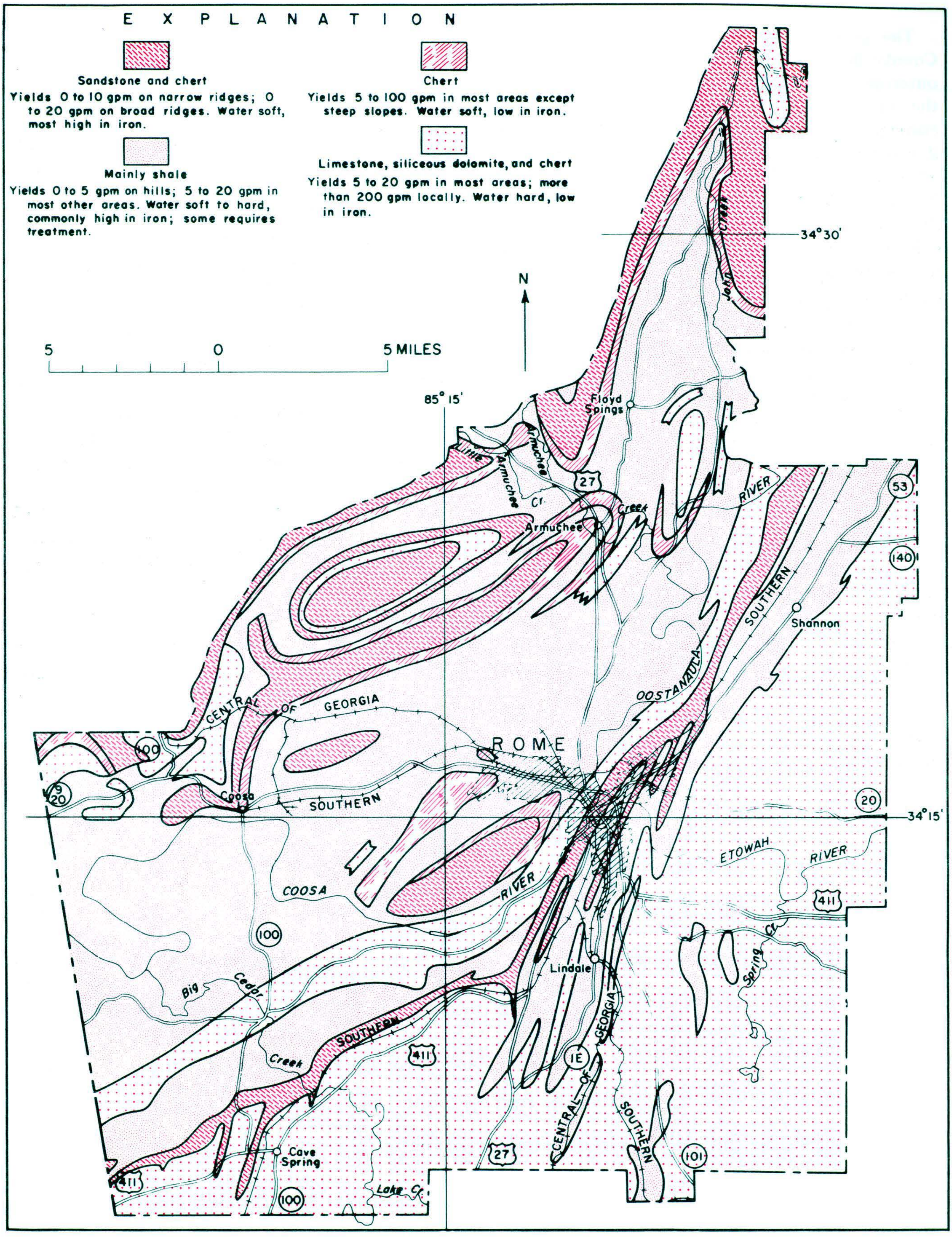

Figure 2. Generalized availability of ground water to wells in Floyd County.

The presence of the Shady Dolomite in Polk County has not been established firmly, but two outcrops there have lithologies that are similar to the Shady in Floyd County and therefore are correlated with it. One outcrop, which is about 2 miles south-southeast of Van Wert, is a 30 to 50-foot section of dolomite faulted between the Rockmart Slate and the Cartersville Fault. The dolomite is medium to dark gray, massively bedded, finely crystalline, and somewhat earthy. Some weathered layers have small pieces of light-gray quartz protruding from their surfaces, similar to those on the Shady in Floyd County, but the rock is almost entirely free of chert. Fractures, widely spaced in most of the outcrop but locally abundant, are filled with white quartz. In nearly all respects, this dolomite closely resembles the dolomite of the Shady along Big Cedar Creek in Floyd County.

Dolomite that underlies the valley 1.5 miles southwest of Van Wert was identified as Shady. It is medium to light gray, thickly to massively bedded and finely crystalline and may be as much as 100 feet thick. Although the dolomite is generally chert free, it is earthy and produces a residuum of siltstone or very fine grained quartzite, plus other siliceous material that resembles jasperoid.

Distribution.—A few feet of the Shady is exposed on Park Drive, north of the Floyd County Public Works Camp. A thin section of the formation crops out between the Rome Formation and the plane of the Coosa fault, in a large cleared area on the west side of the ridge about a mile north of Park Drive. The best exposures of the Shady and the ones showing the contact with the Rome Formation occur on the north bank of Big Cedar Creek, east of the bridge on Spout Springs Road, and in the first road cut southeast of that bridge.

The Shady in Polk County crops out beneath the Cartersville fault about 2 miles south-southeast of Van Wert, and in the valley 1.5 miles southwest of Van Wert.

Stratigraphic relations.—As the contact between the Shady and the Rome Formation is gradational, the contact was placed at the base of the lowest bed of maroon shale in the Rome. The dark-gray shale overlying the dolomite of the Shady was included as part of the Shady because similar shale occurs lower in that formation, whereas nothing like it occurs in the Rome. The contact is well displayed on the north bank of Big Cedar Creek and along the road southeast of the creek bridge.

Hydrology.—The Shady seems to have little potential as an aquifer along most of its outcrop in Floyd County because it underlies steep slopes. Domestic supplies may be obtainable in the few places where the formation is dissected, such as the low area near Park Drive south of Rome. Larger yields may be available where the Shady is crossed by Big Cedar Creek, but the area in which to place a well is small and by having to drill close to the Creek, there is a likelihood of pumping surface water.

The Shady in Polk County is an aquifer only in the valley 1.5 miles southwest of Van Wert where it underlies a broad low area that has recharge available from a stream. Wells there probably will supply from 5 to 50 gpm or more. Well 5FF15, which is 186 feet deep and cased to 80 feet, supplies a home and farm. The well water is hard, but otherwise is of good quality.

A pool spring on the valley floor has a small discharge that is used as a domestic and farm supply.

Rome Formation

The Rome Formation of Early Cambrian age was named by Hayes (1891, p. 143) for exposures south of Rome, Ga. No type section was specified, but Hayes probably named the formation for exposures on the ridge that now is crossed by Park Drive and Walker Mountain Road. The massive quartzites in the upper part of the formation are particularly well displayed on Walker Mountain Road.

Lithology and thickness.—The Rome consists of between 500 and 1,000 feet of interbedded shale, siltstone, sandstone, and quartzite, in that order of abundance. Most of the shale and much of the thin-bedded sandstone and siltstone are brightly colored in hues of red, purple, green, yellow and brown. Alternating layers of varicolored rock produce a striking effect that is unique in the area. Most of the thick layers of sandstone and quartzite are very light gray, but upon exposure alter to tan or rusty brown. Thickly layered sandstone and quartzite occur mainly in the upper half and

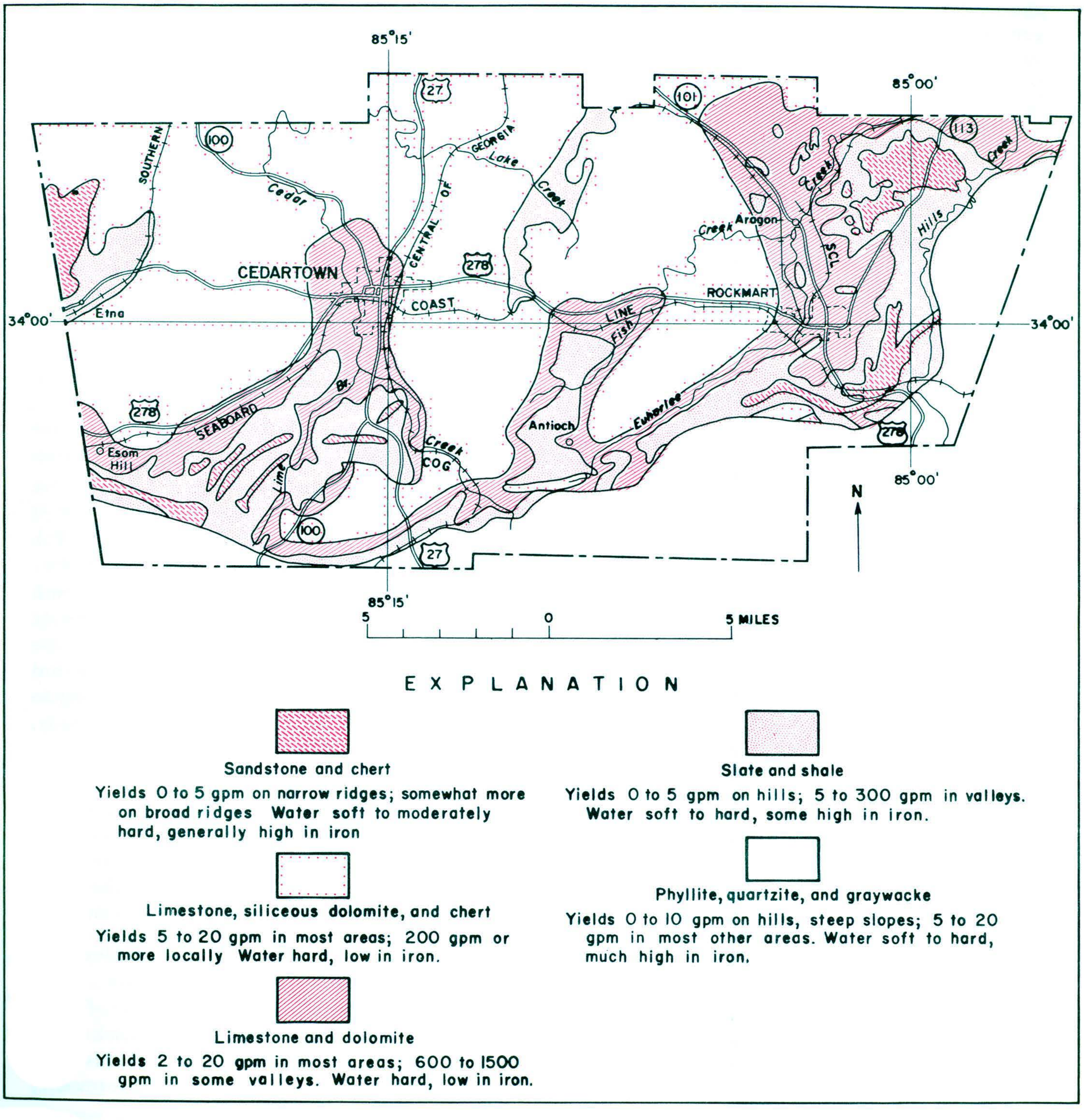

Figure 3. Generalized availability of ground water to wells in Polk County.

are most abundant near the top of the formation.

A good exposure of the Rome and one that shows the rarely exposed base of the formation can be seen along the bank of Big Cedar Creek, east of the bridge on Spout Springs Road. The lower 50 feet of the Rome consists of red or maroon shale and thin-bedded reddish siltstone. This is followed by 100 or more feet of red and tan siltstone and a little maroon shale containing very fine-grained sandstone in beds 3 to 6 inches thick. The middle part of the Rome is made up chiefly of thin-bedded, generally fine- to medium-grained white, yellow, tan, purple, and pale red sandstone intercalated with similarly colored siltstone and red, purple, green, tan, or yellow shale. The upper one-third of the formation is composed of shale and siltstone almost the same as that lower down, but it is interbedded with sandstone and quartzite that increases in abundance and becomes thicker bedded toward the top. Layers 2 to 4 feet thick are common and a few beds exceed 6 feet in thickness. Where fresh, the sandstone and quartzite are light gray, but upon exposure they change to light brown.

The quartzite in the upper part of the Rome varies somewhat in character with the locality. In the City of Rome, at the intersection of Glenn Milner Boulevard and East 6th Avenue, the quartzite is very fine grained, massive, though thinly bedded, and has a banded weathering surface caused by the alternation of light to medium-gray, and tan-weathering layers. The quartzite forming the low ridge between the tracks of the Southern Railway and the Central of Georgia Railway, between the Lindale and Old Lindale Highways just south of Rome, is very fine grained, laminated, and crossbedded. It is composed principally of rounded quartz grains and contains some detrital feldspar grains (Laurence, 1961, p. 39).

The thickly to massively bedded very fine-grained quartzite and maroon shale that forms the small ridge above the Shady Dolomite in the valley 1.5 miles southwest of Van Wert, Polk County, tentatively is identified as Rome on the basis of its lithology and the assumption that the underlying rock is correctly identified as Shady.

Northeastward from Rome, the formation becomes progressively less sandy; sandstone beds are fewer, thinner, and finer grained. The upper one-fourth of the formation, in contrast to the section south of Rome, is almost devoid of sandstone. Much of the upper shale lacks the characteristic bright colors, making it difficult to determine accurately the top of the formation. Several layers of material in this part of the outcrop appear to have been derived from carbonate.

<u>Distribution.</u>—The Rome is fairly resistant to erosion and makes up a series of knobby ridges of moderate relief that reach diagonally across Floyd County. From the Alabama State line near Cave Spring, the ridges extend northeastward through Rome and Shannon. Almost all exposures of the Rome are faulted on the west or northwest side, so that only the upper half to three-quarters of the formation crops out. The entire section of the Rome appears at the surface only along segments of the Coosa Fault between Rome and Cave Spring, where the Shady Dolomite replaces the Rome Formation as the base of the Coosa thrust sheet.

The formation is well displayed at several places within the city limits of Rome, especially east of the Civic Center and near the Fair Grounds. The Rome was uncovered south of East Rome Elementary School during construction of the south extension of Turner McCall Boulevard. Massively bedded quartzite typical of the upper part of the Rome is exposed beside Glenn Milner Boulevard at East 6th Avenue. Dolomite that may belong to the Rome, but which may be part of the Shady, crops out just north of Glenn Milner Boulevard at East 4th Avenue.

So far as is known, outcrops of the Rome in Polk County are limited to the faulted ridges about 2 miles west of Georgia Highway 101 at the Floyd County line and to the low ridge along the south side of the valley, 1.5 miles southwest of Van Wert.

<u>Stratigraphic relations.</u>—On Walker Mountain Road, the highest sandstone bed in the Rome Formation is overlain by several feet of varicolored shale and siltstone of the typical Rome type. Thus, the uppermost sandstone layer is not a satisfactory indication of the top of the formation as was suggested by Hayes (1902).

The highest colored shale and siltstone of the Rome are followed by several feet of yellow and tan, rather nondescript shale, and very thinly bedded siltstone that grade upward into greenish and tan-weathering shale of the Conasauga Formation. Every place where the contact between the Rome and the Conasauga was observed, it appeared to be gradational, the transition taking place through an ill-defined zone about 10 feet thick.

Hydrology.—Ground water in the Rome occurs mainly in secondary openings produced by fracturing and jointing and, thus, is available primarily from the thicker layers of siltstone, sandstone, and quartzite. Yields from the Rome generally are smaller than from other sandstone aquifers in the area, because the large amount of shale in the formation impedes the downward movement of water, reducing the rate of recharge.

Wells inventoried in the Rome Formation range in depth from about 80 to 140 feet and average about 100 feet deep. In the upper part of the formation where sandstone and quartzite layers are better developed, wells generally yield between 5 and 10 gpm, and some reportedly will furnish 20 gpm. Lower in the section where shale is the predominant rock type, yields are generally around 1 or 2 gpm.

The well water reportedly varies from soft to hard, though most of it is soft and some contains a high concentration of iron. Water sampled from well 5JJ21 had a total hardness of 53 ppm (parts per million) and an iron content of 0.07 ppm (table 2).

Conasauga Formation

The Conasauga Formation of Middle and Late Cambrian age was named by Hayes (1891, p. 143, 144-145) for exposures along the Conasauga River in Whitfield and Murray Counties, Ga.

In the area of this report, the Conasauga occupies two belts in which the formation differs significantly; the belts are several miles apart and occupy different depositional environments. The western belt includes all outcrops of the formation in Floyd County northwest of the Coosa Fault. The other, the eastern belt, takes in all of the Conasauga in Floyd County southeast of the Coosa fault, as well as all of the outcrops in Polk County. Because of their lithologic differences, the two belts are discussed separately.

Eastern belt

The Conasauga forming the eastern belt extends diagonally across Floyd County from the Gordon County line past Rome to the Alabama State line. Branches off the main belt occur in southeast Floyd County and in Polk County.

Lithology, thickness, and distribution.—In the part of the eastern belt lying between Rome and the Gordon County line, the Conasauga consists of limestone and shale in nearly equal proportions. The lower part of the formation is made up of 100 feet or more of medium-gray, massively bedded limestone. A good outcrop of the limestone occurs beside the road about 1.5 miles north of the center of Shannon. The limestone is followed by several hundred feet of olive and tan shale, which is used extensively for the manufacture of brick at Plainville just across the line in Gordon County.

The middle of the formation includes thick, apparently discontinuous layers of massively bedded, medium-gray, oolitic and nonoolitic limestone that grades into and is interbedded with olive and tan shale.

Southwest of Rome, toward Cave Spring, the proportion of carbonate increases so that shale is important only in the lower part of the formation. As can be seen along Big Cedar Creek, the lower part is mainly olive shale that becomes interbedded with and finally is replaced by coarse oolitic, medium gray and dark gray, thickly to massively bedded limestone farther up. The middle and upper parts of the formation are chiefly medium- to dark-gray, massively bedded limestone with only a small amount of yellow and tan-weathering shale scattered throughout or derived from the decomposed limestone. Near the top, the limestone gives way to light- to dark-gray, fine-grained, locally oolitic dolomite. The dolomite is distinctively different from that in the overlying Knox Group, as it has a smooth, rounded weathered surface and lacks the crisscross depressions that typify the weathered rock in the lower part of the Knox. Moreover, it is entirely lacking in bedded or nodular chert. The dolomite is exposed in the cut of U. S. Highway 411, about 1 mile northeast of the bridge over Big Cedar Creek.

Southwest of Cave Spring, carbonate rocks constitute an even greater part of the Conasauga. Limestone apparently dominates the middle part, and dolomite makes up most of the upper third of the formation. Dolomite crops out at several places along U. S. Highway 411 near the Alabama State line. On fresh exposures the dolomite appears to be fairly pure, but upon weathering it leaves a residue of siliceous oolite and a few layers of fine-grained sandstone.

The upper part of the Conasauga consists of several hundred feet of calcareous olive-gray and tan shale interbedded with thick sections of massively bedded, blue-gray ribboned limestone and some gray dolomite. One shale unit is thick and makes up a prominent ridge that runs subparallel to Georgia Highway 53 near the Gordon County line. Ribboned limestone is well displayed near spring 5JJS51 southwest of Hermitage. The proportion of limestone increases upward until it completely replaces the shale at the top of the formation. The uppermost 200 to 300 feet of limestone and dolomite are equivalent to the Maynardville Limestone of Tennessee, as shown by fossils at the U. S. National Museum. The total thickness of the Conasauga northeast of Rome is about 1,500 feet.

From U. S. Highway 411, the Conasauga extends southward for a distance of about 2 miles into Polk County. Although it is not exposed, the soil and topography indicate that the formation there is chiefly limestone and dolomite.

In southeastern Floyd County, exposures are so limited that the makeup of the Conasauga could not accurately be determined. However, the amount of shale present in the reddish carbonate soil indicates that the lithology probably is similar to that in the area northeast of Rome.

Hydrology.—In the eastern belt, from the Gordon County line to a short way south of Paris Lake, including the outcrops in southeast Floyd County and the one in north-central Polk County, most wells yield between 2 and 25 gpm. The average depth of the wells is about 120 feet, but some are deeper than 300 feet. It may be possible to obtain far higher yields from wells drilled in limestone, as one well in the formation south of Calhoun in Gordon County produced nearly 300 gpm.

The range in well yields largely reflects the different lithologies in the formation. Nearly all of the low yielding wells are in shale, whereas the better producing ones are partly or wholly in limestone. To some extent in the shale, but more so in the limestone, the amount of water obtained depends largely on the topographic position of the well site; wells positioned near the bottom of local drainage courses normally are the best producers. Even poorly defined drainage courses that flow only during wet periods are good drilling sites, as they tend to concentrate the flow of ground water and increase the quantity available to a well.

The quality of the well water varies from soft to hard, depending on the type of rock from which it is derived. The water generally has a low iron content.

A few springs discharge from this part of the Conasauga but they are small. Spring 5JJS1, about 1.75 miles south of the center of Shannon, flows about 0.58 mgd (million gallons per day) and is used for domestic supply (table 3). Hermitage Spring (5JJS4) has about the same flow. Spring 4HHS3 at Lindale discharges from limestone in the upper part of the formation and is used by an industry. Wells at this site were reported to furnish from 5 to more than 50 gpm; nearly all of the wells supply more than 10 gpm. The wells average about 80 feet deep. The deepest well was 105 feet. Water from this segment of the formation generally is moderately hard to hard.

Along the faulted valley that extends from near Hematite Crossing, Polk County, northward to the Floyd County line, several springs discharging into Little Cedar Creek have a combined flow of 3 to 7 mgd, depending on the time of year. Unfortunately, most of these are seep springs located on the poorly drained valley floor and are subject to flooding. Protecting them from pollution would require extensive improvements. Those few that are situated some distance from the creek offer the best possibility for development.

Western belt

The Conasauga, in the western belt, underlies most of the Coosa Valley southwest of Rome and large areas of Floyd County northeast of Rome. The rocks in the belt can be divided into three fairly distinct units although the contacts between them tend to be gradational and faulting and folding has brought about a mixing of types in some areas. Accurate differentiation of the units along much of their length is difficult or impossible because the ground is covered by thick alluvial and colluvial deposits. These deposits likewise are a major obstacle to further subdivision of the formation.

Lower Unit

Lithology and distribution.—The lower unit of the western belt crops out in a strip about a mile wide that lies along the southeast side of the Coosa Valley, paralleling the Coosa Fault. It is composed of compact olive-green silty shale and greenish fine to medium-grained sandstone in beds less than 6 inches thick. Both the shale and sandstone are calcareous where fresh. The shale weathers to tan or pinkish orange and in so doing, breaks down into small pieces having irregular surfaces. The lack of planar surfaces on the weathered shale sets it apart from the shale in the remainder of the formation. The sandstone, which is interbedded randomly throughout the shale, weathers to rusty brown. In the area west of Cave Spring, thin-bedded limestone occurs with the sandstone and shale.

Close to the Coosa Fault, deformation in the lower unit has been so intense that the shale is crumpled, crenulated, and sheared, and some is reduced to a mass of closely spaced slickensided surfaces. Much of the sandstone is reduced to highly fractured lenses and discontinuous layers 1 to 4 inches thick, crisscrossed by white quartz or calcite fracture fillings.

The lower unit is readily distinguishable from the remainder of the formation by the extremely crumpled and sheared character of its shale, the presence of fractured sandstone, and the angularity of the weathered shale pieces. Moreover, it forms noticeably more rugged and somewhat higher terrain.

Hydrology.—Only one well was inventoried in the lower unit. It was 175 feet deep and supplied 8 gpm. Wells in the unit probably can be expected to furnish between 2 and 10 gpm in most areas, and the yield may be appreciably higher wherever sandstone is prominent. The water probably will be soft to moderately hard and may contain significant quantities of iron.

Middle Unit

Lithology and distribution.—The middle unit of the western belt crops out in a band about a mile wide that parallels the lower unit. Its chief constituent is massively bedded medium to dark-gray limestone, which is interlayered with varying thicknesses of olive-gray and tan shale. Some of the limestone is moderately pure and produces a deep red soil, but most contains a large amount of silt and clay that remains as a tan shale residuum. Except where erosion is active, the residual shale obscures the limestone creating the illusion that shale is the principal constituent of the unit.

A common type of limestone in the unit is made up of half an inch to 2-inch thick layers of relatively pure calcium carbonate that alternate with silty, argillaceous, generally dolomitic layers of about the same thickness. As the rock weathers, the impure carbonate becomes tan or brown in contrast with the gray color of the purer layers to produce a distinctive banded or ribboned surface.

Still other limestone in the unit is very massive, but contains dark gray to black clay and silt laminations about 1 millimeter thick between the beds. The laminations appear as dark, irregular lines on the rock surface. As the limestone is leached, it loosens along the laminations and breaks up into thin slabs. Where the rock has come under severe stress, as in the quarry of the Floyd County Public Work Camp, movement was concentrated along the laminations which became phyllitized and heavily slickensided.

The limestone in the unit, as in nearly all of the Conasauga in the State, has been highly fractured and these openings are filled with white or, rarely, pink calcite and by white quartz.

Hydrology.—Eighteen wells inventoried in the middle unit of the western belt ranged in depth from 68 feet to about 300 feet, averaging about 133 feet deep. Most wells were reported to supply between 5 and 10 gpm though most probably are capable of far higher yields. The water is of good quality for domestic use and moderately hard to hard.

Upper Unit

Lithology and distribution.—The upper unit of the western belt occupies a far broader belt than the two lower units combined and probably is much thicker.

The lower part of the upper unit, having an outcrop width of about a mile to a mile and a half in the Coosa Valley, and one considerably wider northeast of Rome, is mainly olive and tan shale containing a large quantity of thin-bedded limestone and calcareous siltstone. This lithology is well displayed along the two roads between Fosters Mill and the mouth of Big Cedar Creek. It also is exposed in the tongue of the formation that extends along the northwest side of Horseleg Mountain and in the northwest part of Rome.

Just above the lower part of the upper unit is a zone about 3 miles wide having a dominant lithology of dark olive-gray, somewhat silty, shale containing abundant mica flakes. The shale weathers to light olive gray and greenish tan. Distributed throughout the silty shale are zones of very dark gray, fairly pure clay shale, that on exposure alters to tan or very light green. This shale has a high carbon content and is very fossiliferous. Both types of shale contain chertlike siliceous nodules up to about 8 inches across that collect on the ground surface, resembling stream gravel. The nodules long have been of interest to paleontologists and collectors because they commonly have trilobites and other Middle Cambrian fauna preserved on their surfaces.

One layer of this dark-gray clay shale cropping out on the east bank of the Coosa River, about 2 miles northeast of the mouth of Big Cedar Creek, contains a profusion of exceedingly well preserved Middle Cambrian trilobites, virtually all one species, *Elrathia georgiensis* Resser (see plate 1, fig. 1). This collecting locality, reported by Allen Sheldon, a former student at Cave Spring High School, represents an outstanding assemblage of specimens of various sizes, ranging from less than 0.1 inch to more than 3 inches long.

From about a mile and a half northwest of the mouth of Big Cedar Creek, northwestward to within about a mile of Early, the upper unit is dominated by olive-green and olive-gray silty shale that contains discontinuous 1-inch to 4-inch thick layers of brown-weathering siltstone and fine-grained sandstone, mainly in the lower part, and very thin nodules and discontinuous layers of impure limestone in the upper part. In the vicinity of Early, however, and along the south edge of Heath Mountain, the shale contains many beds of thin- to medium-bedded olive-gray siltstone and medium dark-gray impure limestone, commonly in aggregates more than 100 feet thick.

North of Early and beside Georgia Highway 20 west of Heath Mountain the unit is mainly massively layered, ribboned limestone and tan-weathering shale resembling the uppermost part of the Conasauga in the eastern belt between Rome and Shannon. Owing to a lack of outcrops the character of the unit could not be determined either in the tongue north of Heath Mountain or for any appreciable distance north of Georgia Highway 20, but the type of soil indicates that it is predominately limestone or dolomite.

Hydrology.—Wells in the predominately shale upper unit yield between 3 and 10 gpm. Of 20 privately owned wells canvassed, the average depth was 100 feet; the greatest depth was 225 feet. Water from the shale generally is soft and low in iron content.

In part of the unit containing limestone and calcareous siltstone, wells can be expected to supply from 5 to 20 gpm. The water is moderately hard to hard.

Attempts to develop large industrial groundwater supplies in the upper unit have, in the main, ended in frustration. Of three wells drilled at Georgia Power Company's Plant Hammond, only one was considered successful. The well (3JJ33) was drilled 411 feet through shale and several strata of limestone and supplies about 100 gpm. The water has a dissolved solids content of 119 ppm and an iron content of 0.36 ppm. Another deep well not far to the east penetrated only shale and was essentially dry. A third well to the west penetrated shale and can furnish about 60 gpm; however, as the water has a high hydrogen sulfide content, it is little used.

Several wells were drilled at the Georgia Kraft Company plant in an attempt to develop a water supply, but none was satisfactory. The wells, apparently in shale, would supply only a few gallons per minute and the water contained too much hydrogen sulfide and iron to be used.

A few small springs discharge from the upper unit and are used for watering stock. A sample of water from 3JJS2 had a total hardness of 80 ppm and an iron content of 0.07 ppm.

Faunal age.—In the western belt, unlike the belt to the east, the oldest part of the Conasauga occurs along the southeast edge of the outcrop. The formation has an overall dip to the northwest and probably is the northwest limb of a broad anticline that was dissected longitudinally by the Coosa Fault. The trilobites *Glossopleura* sp. and *Kootenia* sp., collected by Preston E. Cloud, Jr., (1967) from the sandstone-bearing shale along the south edge of the Coosa Valley in Cherokee County, Ala. (on strike with the lower unit of this report), show that part of the formation is Middle Cambrian. Shale in the center of the Coosa Valley in Floyd County contains the trilobite *Elrathia georgiensis* Resser, and other late Middle Cambrian fauna. Several trilobites from the northern edge of the outcrop at Cedar Bluff, Ala. (Butts, 1926, p. 75), and the trilobites *Tricrepicephalus* sp. and *Acmarhachis ulrichi* (Resser) (see plate 1, figs. 2 and 4) from West Rome are of Late Cambrian age (U.S.G.S. Colln. No. 4415-CO).

Cambro-Ordovician Sediments

Knox Group

The Knox Group of Late Cambrian and Early Ordovician age was named by Safford (1869) for developments in Knox County, Tenn. In Georgia, the Knox Group includes three formations: the Copper Ridge Dolomite of Late Cambrian age, followed by the Chepultepec Dolomite and by the Longview Limestone, both of Early Ordovician age (Butts and Gildersleeve, 1948, p. 16).

Copper Ridge Dolomite

Lithology and thickness.—The Copper Ridge Dolomite consists of light- to medium-gray, fine- to coarse-grained, thickly to massively bedded cherty dolomite, and brownish-gray, medium to coarse-grained, asphaltic dolomite that has a distinctive fetid odor on fresh breaks. The brownish-gray dolomite appears to be dominant in the lower part of the formation, but is subordinate to the light gray dolomite in the upper part.

The thickness of the Copper Ridge could not be determined in either Floyd or Polk Counties due to poor exposure, but in Catoosa County, Ga., the only place in the State where the Knox Group has been measured, it is nearly 3,000 feet thick. It may be that thick in western Floyd County and in Polk County.

The dolomite of the Copper Ridge is highly siliceous and yields large volumes of chert and clay residuum. The chert occurs both as layers and as boulder-like chunks that vary from light to dark gray, depending on the state of weathering, and it generally is very hard and vitreous and has a jagged surface. Accumulations of chert and clay create a residual mantle over the formation that generally is between 50 and 200 feet thick and commonly exceeds 300 feet in thickness.

Chepultepec Dolomite

Lithology and thickness.—The Chepultepec Dolomite in the study area has such limited bedrock exposure that its lithology could not be determined. The nearest exposure of the formation is in Catoosa County, Ga., about 50 miles to the north but its lithology probably is similar in both places. In Catoosa County the Chepultepec is about 500 feet thick and consists mainly of light- to medium-gray dolomite in thick to massive layers. Interbedded with the dolomite are a few beds of gray and tan aphanitic limestone. Sandstone occurs near the base and close to the middle of the formation.

The Chepultepec is covered by moderately thick accumulations of chert and clay residuum. Much of the chert is soft and cavernous and, in general, the terrain over the Chepultepec is littered with smaller size pieces of chert that weather from the formations above and below. A few pieces of sandstone may be present in the soil, particularly over the lower part of the formation.

Longview Limestone

Lithology and thickness.—Limited exposures indicate that in Polk and Floyd Counties the Longview Limestone consists of massively bedded medium- to light-gray dolomite, interbedded with medium- to light-gray aphanitic to medium-grained thickly bedded limestone. In Catoosa County, Ga., the upper part of the formation is roughly 50 percent limestone, but in Polk County nearly all of the formation seems to be dolomite.

The residuum of the Longview tends to be very thick and is littered with large chunks and pieces of hard angular chert and a little sandstone. In Polk County some outcrops of the Longview display chert layers more than 6 feet thick; these break down and show up in the residuum as boulder-like chunks of chert that litter the landscape.

Fauna and correlation.—The highest outcrops of dolomite and chert on Horseleg Mountain yielded several specimens of *Scaevogyra* sp. (U.S.G.S. Colln. No. 4417-CO) that are conspecific with material identified by Ulrich and by Butts (1926, p. 88) as *Scaevogyra* cf. *S. swezeyi* Whitfield (see plate 1, fig. 3). The species was described from the St. Lawrence Member of the Trempealeau Formation of the Upper Mississippi Valley.

Scaevogyra swezeyi is an excellent guide to the Trempealeauan stage of the Upper Cambrian. According to Ellis L. Yochelson, it probably is limited to the lower third of the Trempealeau Formation and its equivalents and the fossils from Horseleg Mountain come from a relatively narrow zone, probably just above the middle of the Knox Group.

These fossils show that on Horseleg Mountain the Longview Limestone, the Chepultepec Dolomite, and probably the upper part of the Copper Ridge Dolomite were eroded prior to deposition of the formations of Middle Ordovician age. Great thicknesses of the Knox Group also may have been eroded from other areas west and north of the Rome fault as is suggested by the extreme narrowness of the outcrops there, and by the presence of the Attalla Conglomerate which everywhere marks this unconformity.

Distribution.—The Knox Group has two principal outcrop areas: one lies northwest of the Rome Fault and is confined to Floyd County; the other is southeast of the Coosa Fault and includes nearly all of southeastern Floyd County and a large part of Polk County. Because of the thick mantle of residuum which nearly everywhere covers the Knox, exposures of bedrock are comparatively rare.

Northwest of the Rome Fault the only known exposure of bedrock is on the southwest end of Horseleg Mountain. High up on the mountain the upper part of the Copper Ridge Dolomite is fairly well exposed.

The Knox southeast of the Coosa Fault is somewhat better exposed, but the total thickness cropping out is small. Thin sections of dolomite are exposed at several places along the banks of the Etowah River and in the cuts of U. S. Highway 411 near that river. A few feet of the basal Knox was uncovered beside the paved road that ascends the ridge 1.4 miles southwest of Hermitage. Sandstone of the Knox is exposed in several road cuts south and southeast of Wax Lake. Massively bedded chert and a little gray dolomite of the upper part of the Knox crop out on the crest of the ridge, 1.5 miles west of the center of the Rockmart.

All three formations of the Knox Group are present southeast of the Coosa Fault. Massive cryptozoan-bearing chert in the residuum adjacent to the Conasauga Formation shows that the Copper Ridge Dolomite underlies much of southern and eastern Floyd County and large parts of Polk County. Chert carrying the gastropod *Lecanospira* sp. confirms that the Longview Limestone occupies the expanses of Polk County and southeasternmost Floyd County adjacent to the Newala Limestone. The Chepultepec, evidenced by an unusual amount of soft, cavernous chert and by sandstone beds, underlies the area between. Although these three formations were recognized, no attempt was made to differentiate them because it would have required too much time, and because the three are similar enough lithologically to be treated as a single aquifer.

Hydrology.—More than half of the wells inventoried in the Knox Group are cased to bedrock and derive water from limestone and dolomite; the remaining wells obtain water solely from the residual mantle above the bedrock. As the hydrologic properties of the bedrock and the residuum differ, and because well construction differs in each, the water-bearing character of the bedrock and the residuum are treated separately.

Bedrock wells: Wells penetrating bedrock normally produce large quantities of good quality water. Approximately two-thirds of the wells inventoried yielded between 5 and 80 gpm and all but one well supplied at least 1 gpm. In depth, the wells average 160 feet; the shallowest well was 50 feet deep, the deepest, 500 feet. Nearly without exception, these wells are cased only a short way into bedrock, leaving the remainder an open hole in rock.

Bedrock wells are most common where the overburden is less than 150 feet thick so that the cost of drilling is not prohibitive. They also are used wherever the desired yield, generally more than

10 gpm, cannot be obtained from the residuum or where a high degree of dependability is desired, as they are not appreciably affected by droughts.

Drilling in other areas of northwest Georgia has shown that wells in the bedrock of the Knox will yield from 200 to 300 gpm or more if they are properly located with respect to the drainage. Many of the large watercourses draining the ridges of the Knox are dry much of the year, because water moving along them is beneath the surface. By drilling far enough down a drainage course to insure adequate catchment area above, or better still, by locating a well where a drainage course empties onto a valley or the flood plain of a stream, it is possible to intercept a large volume of ground water.

The quality of water from the bedrock varies from moderately hard to hard and normally has a low iron content. Only a few wells were reported to yield water containing noticeable quantities of iron. Water from well 3FF15 had a total hardness of 160 ppm and an iron content of 0.10 ppm.

Wells in residuum: The residual mantle blanketing the Knox Group nearly everywhere is at least 25 feet thick and in many places is more than 300 feet thick. Over most of the outcrop area it probably ranges between 50 and 150 feet thick.

On slopes where it has undergone soil creep, or in low places into which it has been transported, the mantle is a heterogeneous mass of cherty clay having low permeability; wells in this material generally yield 1 or 2 gpm. The remainder of the mantle, however, although it consists mainly of clay, contains well-defined permeable layers.

The only information available about the character of the residual mantle at depth was supplied by Mr. E. W. Renshaw, geologist with American Cyanamid Company, who has directed extensive test drilling in the Knox Group. According to Mr. Renshaw (oral communication, 1966), the mantle which is mainly clay contains layers of silt, sand, sandstone, broken chert, the latter probably derived from the breakup of thick chert beds. These layers appear to have wide lateral extent and, in general, they are very porous and permeable; those that are water-bearing can yield 5, 10, or perhaps as much as 15 gpm to a well.

That the clay material separating these permeable layers is very tight is demonstrated by the fact that test holes placed only 2 to 5 feet apart (unless they penetrate a permeable layer) rarely lose drilling water from one to another even though the water is under a pressure of 100 to 400 pounds per square inch. Thus, it is apparent that appreciable quantities of ground water are available in the residuum only where permeable layers are present.

In developing a well in residuum, it is common practice to drill until a water-bearing zone is reached. If the yield is adequate, casing is set to total depth, leaving only an open hole in the bottom of the pipe to admit water. Thus, because of the restricted intake area, the full potential of the water-bearing zone rarely is utilized. If a well penetrates a thick layer of water-bearing material, or if more than one layer is encountered, slotted casing may be used to increase the yield, but the practice is not common. A few gravel-packed wells have been developed in the residuum, and their yield commonly exceeds 10 gpm.

Rapid declines in yield have been a problem in a few wells cased with solid pipe to total depth. The trouble apparently results from chert fragments, sand, and clay being sucked into the casing. As this material accumulates, the yield declines.

More serious plugging has resulted in some wells that end near the top or near the bottom of a water-bearing zone. Water entering the casing carries loose material with it, leaving a void into which clay may be squeezed by the weight of the overlying material. If clay is forced into the casing, productivity of the well is reduced or stopped. Well 4HH2 went dry after soft material, probably clay, pushed up from below, plugging the casing.

Many people prefer water from the residuum because the water is softer and contains less iron, but well yields generally are less than from the bedrock.

Springs: Several important springs discharge from the Knox Group. In Polk County, Youngs Spring (4FFS3) flows at the rate of about 0.5 mgd. A sample of the water had a total hardness of 108 ppm and an iron content of 0.02 ppm. This is a pool spring situated on the valley floor and would require moderate improvement to prevent pollution. It is only a few yards from the Central of

Georgia Railway.

In Floyd County, four principal springs have a combined flow of about 9.5 mgd. The largest flow is about 5.0 mgd from Old Mill Spring (3GGS3), just southwest of the town of Cave Spring. A sample of the water had a total hardness of 96 ppm and an iron content of 0.01 ppm. This is a seep spring that discharges from a wide area so that a considerable enclosure would be required to prevent pollution. The spring is on the side of a ridge, high enough for the water to flow by gravity to the nearby valley. It is about a third of a mile from the Southern Railway.

Cave Spring, in the town of the same name, discharges about 2.5 mgd, half of which currently is being utilized. A sample of this water had a total hardness of 111 ppm and an iron content of 0.03 ppm. As the name implies, this spring flows from a cave so that the water can be obtained before it reaches the surface and no sanitary improvements are required.

Morrison Camp Ground Spring (5JJS2), about 5 miles east of Rome, flows at the rate of about 0.85 mgd. A sample of the water had a total hardness of 54 ppm and an iron content of 0.05 ppm. The spring presently is used for domestic supply and to furnish a summer camp, but only a minor part of the volume is required.

Youngs Mill Spring (5JJS3), about 8 miles east of Rome, is a large seep spring that flows at the rate of about 2.0 mgd. The spring discharges over an area of perhaps an acre, and at present is covered by back water from a private lake. For this reason, a water sample was not taken but the quality should be the same as that of other springs in the Knox. Because this spring discharges in the bed of a wet weather stream and covers a broad area, extensive development would be required.

Spring 5HHS1, about half a mile southeast of Wax Lake, is a seep spring flowing around 1 mgd. Water from the spring had a total hardness of 78 ppm and an iron content of 0.11 ppm. Water seeps from a large area, though it is concentrated in several spring runs. The usefulness of the water will depend on the amount of improvement that is given the spring. Heavy rainfall currently produces a high turbidity, largely from material carried in by surface-water runoff.

Harry Marion Spring (4HHS1), about 3 miles southwest of Lindale, discharges 1.2 mgd. The spring water had a total hardness of 116 ppm and an iron content of 0.09 ppm. Because this is a seep spring covering a broad area, it probably would be difficult to develop.

Several other springs discharge from the Knox, but the flow of most is less than 0.5 mgd. A few of the springs presently are being used for industrial or other purposes.

Ordovician System

Newala Limestone

The Newala Limestone of Early Ordovician age was named by Butts (1926, p. 95) for Newala Post Office, Shelby County, Ala.

Lithology.—On the east side of Polk County and in southeastern Floyd County, the Newala consists of limestone and dolomite, apparently in nearly equal proportions, although limestone seems to be somewhat more abundant in the upper part. Around Grady and Cedartown, limestone accounts for a larger part of the formation, but dolomite remains prominent.

The limestone varies from light gray to medium dark gray and is fairly pure. Bedding generally is thick to massive, commonly between 1 and 4 feet thick but beds less than 1 foot thick occur. Some beds contain thin sandy zones that weather out in slight relief producing a banded surface. The dolomite is light to medium gray, fine to coarsely grained and most is massively bedded. Some dolomite layers exceed 6 feet in thickness.

The top of the Newala locally is marked by an edgewise conglomerate consisting of argillaceous limestone pieces incorporated in a bed of fairly pure limestone. This conglomerate can be seen in the small quarry 1 mile northeast of the Marquette Cement Company plant near Rockmart, immediately beneath the Lenoir Limestone.

Where the Newala crops out near the Cartersville Fault, the limestone layers are marbleized, but the dolomite remains unaltered. Marbleized limestone interbedded with dolomite is exposed on a low hill south of U. S. Highway 278 (just south of well number 5FF17), 2 miles southeast of Van Wert. Similar outcrops occur on a hill about 2 miles south-southeast of Van Wert.

Near Rockmart and Grady and to some extent around Cedartown, the limestone of the Newala has a distinct, though in many places faint, cleavage. The growth of mica along the cleavage planes imparts a foliation to some of the rock that gives the weathered surfaces a slaty look. Where cleavage is strongly developed, the mica layers are very hard and remain in the soil, faintly resembling weathered Rockmart Slate

The cleavage in the limestone generally is subparallel to the bedding, but locally the two planes diverge rather sharply and where the growth of mica is great, the cleavage can be mistaken for bedding. Dolomite beds, however, which are not visibly cleaved are present nearly everywhere and indicate the true bedding.

Generally, the Newala contains either widely scattered chert nodules or a few thin discontinuous chert beds, but in a few places it is unusually siliceous and yields both nodular and bedded chert in abundance. Where this occurs at the base of the formation, chert from the Newala gets mixed with chert from the underlying Knox Group, making separation of the two very difficult. The basal part of the Newala is cherty southwest of Cedartown.

Except for the outcrop in the southeast corner, the Newala was not positively identified in Floyd County but the rocks cropping out at the west base of Simms Mountain, a few hundred feet south of the Chattooga County line, may belong to the Newala. At that place, the formations of Middle Ordovician age are underlain by 20 or 30 feet of massively bedded dolomite that is mottled in shades of pink and green and is virtually identical to dolomite in the Newala several miles to the northwest. However, as no fossils were found the identification is questionable, so the dolomite was mapped as part of the Knox Group.

Distribution.—The Newala is present in large areas of Polk County where it underlies valley areas between ridges formed by the Knox Group and the Rockmart Slate. It is widespread in the lowlands around Rockmart, Grady, and Cedartown, and forms a narrow valley extending from Cedartown to Esom Hill. The Newala also forms a large part of the valley at Etna and Oremont.

The Newala is well exposed in the large abandoned quarry at Portland (Davitte), at several places along the road between Aragon and Taylorsville, and beside the road that runs north out of Aragon. The upper part of the formation is displayed in the quarry about 2 miles north-northeast of the center of Rockmart, and along the south edge of the large quarry beside Georgia Highway 101, immediately north of Rockmart. The Newala crops out on several hills in and near Rockmart and along Georgia Highway 113 between Rockmart and Taylorsville. An excellent exposure of the upper part of the Newala can be seen in the Deaton iron mine west of Taylorsville.

In central Polk County, exposures of the formation are very limited. The upper limestone and dolomite crop out near Antioch School about 3 miles south of Grady and along a creek 1.25 miles southwest of Antioch School, and in a wooded area across the unpaved road half a mile southeast of the latter exposure.

In and around Cedartown, small thicknesses of the formation are exposed in numerous places, particularly along the stream courses. Farther west, it is exposed in the bottom of an abandoned mine 1 mile southwest of Old Brewster School and in the cut of U. S. Highway 278, about half a mile northwest of that school. A few feet of limestone and dolomite of the upper part of the Newala have been exposed in the bottom of an abandoned iron mine on the side of the ridge, about a quarter of a mile southeast of Oremont.

Thickness.—The thickness of the Newala in Polk and Floyd Counties never has been accurately determined, primarily because the formation is overlain by deep colluvium and only partial sections are exposed. Furthermore, the lack of good stratigraphic control precludes piecing together an entire section. Judging by the hills north of Aragon, however, where at least 100 feet of section crop out, and by the great distance to the contact with the Knox Group, it seems probable that the Newala is at least 300 feet thick.

Fauna and correlation.—A key feature of the Newala is its fossils. Calcareous fossils of various types are visible in cross section on the weathered surfaces of much of the limestone, but they are of little use in correlation. Silicified gastropod shells, for the most part poorly preserved, can be collected from the soil in some areas and are helpful in dating. The best guide to the Newala is *Cera-*

topea, a genus whose stratigraphic interval in Georgia is limited entirely to that formation.

The gastropod *Ceratopea* is best known from its operculum. The ceratopean shell rarely is silicified and therefore is not preserved. The opercula, on the other hand, commonly are silicified and occur with fair abundance in the limestone. They are very resistant to weathering and remain well preserved in the residuum of the formation. *Ceratopea* is especially important because several species have wide geographic distribution yet are restricted to narrow stratigraphic zones. Thus, the opercula are very useful in interregional correlation.

In Polk County, *Ceratopea* opercula were used to separate the Newala and the Knox Group where the two formations are lithologically similar. They also were used in conjunction with other fossils to determine the upper limit of the Newala and establish the contact with the Middle Ordovician Lenoir Limestone. More importantly though, *Ceratopea* provided the indisputable evidence that enabled a complete reinterpretation of the stratigraphy and structure of the important iron mining center at Etna and Oremont. These fossils make it clear that the iron there is concentrated in the residuum of the Newala Limestone rather than in that of the Shady Dolomite, as previously thought.

Ceratopea opercula have been examined and collected from the Newala in all principal outcrop areas in Polk County, but by far the largest collection and the one containing the greatest number and variety of species came from the residuum in the iron mines near Oremont. More than 300 specimens were taken from a single mine located on the side of the ridge about a quarter of a mile southeast of Oremont (U.S.G.S. Colln. No. 6294-CO). According to Ellis L. Yochelson this collection includes (see plate 1):

Ceratopea capuliformis Oder
C. corniformis Oder
C. germana Yochelson and Bridge
C. incurvata Yochelson and Bridge
C. keithi Ulrich
C. subconica Oder
C. "subconica" Oder
C. sulcata Oder
C. tennesseensis Oder
C. new species?

Other fossils taken from limestone in the bottom of the same mine (U.S.G.S. Colln. No. 6294-CO) include: *Orispira* sp., indeterminate but probably similar to *O. depressia* Cullison; *"Helicotoma" unangulata* Hall; high spired gastropod aff. *"Turritoma"*; moderately high-spired gastropod with narrow selenoizone aff. *Plethospira*; and small operculum. Of this group, Yochelson states, "these fossils all are characteristic of the Newala."

Occurring with the *Ceratopea* in the uppermost extremity of the mine were specimens of *Orospira*, *Helicotoma*, ? *Lesueurilla*, and the columella of moderately high-spired gastropods. According to Yochelson, the presence of *Helicotoma* suggests that the Newala in this mine may be overlain by limestone of Middle Ordovician age as it is farther east.

Ceratopea was collected from several other mines in the valley between Etna and Oremont and north of Oremont. They make it clear that the iron ore is concentrated chiefly in the residuum of the Newala Limestone but *Lecanospira* sp., found in a few mines, indicates that some of the ore probably is in the residuum of the Longview Limestone as well.

Detailed zonations have been worked out for several species of *Ceratopea* in other parts of the United States (Yochelson and Bridge, 1957, p. 183). From this work, it is known that all of the species found in the Oremont area are from what is roughly the lower half of the *Ceratopea* zone of other regions. The assemblage from Oremont includes *Ceratopea capuliformis* Oder which is one of the oldest species known, and *C. tennesseensis* Oder (see plate 1, figs. 5 and 9), which occurs at about the middle of the zone in the Arbuckle Mountains, in west Texas, and in eastern Tennessee.

The presence of *Ceratopea capuliformis* Oder on a few mine dumps around Oremont shows that weathering has reached the lowest beds in the Newala in several places, but it does not seem to have progressed to that depth over the whole area. In the mine a quarter of a mile southeast of Oremont, *C. capuliformis* Oder was brought up from the bottom of a deep funnel shaped ore body that is enclosed in younger limestone. Weathering may extend to the basal part of the Newala only where the downward movement of ground water is concentrated.

Field studies made by Yochelson and Cressler in 1966 indicate that the highest Newala on the east side of Polk County is in the zone of *Ceratopea tennesseensis* Oder, the same as the youngest known Newala on the west side of the county. Thus, the fossils so far found show that the Newala across the breadth of Polk County is about the same age, and equals approximately the upper part of the Kingsport Formation and the lower part of the Mascot Dolomite in east Tennessee and equivalents in other regions.

It is not known whether beds of Newala Limestone younger than those now present were deposited in Polk County and subsequently eroded, but this seems likely. *Ceratopea unguis* Yochelson and Bridge (plate 1) collected in Bartow County, Ga., about 10 miles to the east, is the youngest species of *Ceratopea* known and shows the Newala there is highest reported in this region. The occurrence of uppermost Newala so close to Polk County indicates that the upper part of the Newala probably was deposited in Polk County, but was eroded prior to deposition of the Rockmart Slate.

Utilization.—Limestone in the Newala of eastern Polk County for many years was quarried to use in the manufacture of cement. The formation, however, never has been a particularly satisfactory source of cement quality limestone because at every location suitable for a quarry at least some dolomite is interbedded with the limestone and must be separated. Several methods of separation were tried including removal of the dolomite by hand but these operations no longer are economically feasible. The more successful quarries were located near the top of the formation where most of the rock is limestone and where a large portion of the recovered rock was the high calcium carbonate Lenoir Limestone.

Hydrology.—The Newala Limestone is the most productive aquifer in the study area. Seven springs discharging from the formation have a combined flow of more than 24 mgd; the largest spring discharges as much as 15 mgd. Wells in the Newala have larger average yields than those in any other formation.

Sixty-seven inventoried wells have an average depth of 147 feet. The shallowest well was 32 feet deep; the deepest,444 feet. Ninety percent of the wells yield more than 5 gpm, 60 percent furnish more than 10 gpm, and 18 percent supply more than 20 gpm. One well, 4FF21, flows. The highest sustained yield is from well 4GG65 near Cedartown, which is pumped continuously at the rate of 650 gpm; well 3GG39 furnishes 1,200 to 1,500 gpm for a period of several hours per day.

Wells drilled in nearly every part of the Newala outcrop can be expected to yield between 2 and 5 gpm from depths of less than 200 feet. Well 2FF5 was the only one canvassed that could not meet domestic requirements. It is 276 feet deep, penetrated the Newala and terminated in the Knox Group.

Wells supplying the largest quantities of water generally are in low areas and most are near surface streams. Ground water tends to concentrate in large solution channels prior to entering a streambed and, therefore, is available in large quantities.

One potentially hazardous problem that was encountered during the development of a large-capacity well in Cedartown should be considered when selecting sites for future wells. A hole drilled near well 4GG65 was being test pumped at a high rate and appeared satisfactory, when the ground around the well began to subside. Continued pumpage resulted in ground collapse. Thus, in the interest of safety, wells intended for heavy pumpage should be positioned well away from buildings or other permanent structures.

The only part of the Newala outcrop where well yields tend to be lower than average is in a narrow strip along the contact with the Rockmart Slate. The slate overlies the Newala and interferes with the percolation of ground water into the limestone. Solution channels are poorly developed and wells there tend to be poor producers.

Water from wells in the Newala normally is moderately hard to hard. It has a low iron content and rarely is affected by hydrogen sulfide. Water sampled from well 3FF13 had a total hardness of 79 ppm and an iron content of 0.05 ppm.

Only one well, 5FF5, was reported to have water high in iron content. The source of the iron was not determined, but it may be derived from the Deaton Member of the Lenoir Limestone. A small outlier of the Rockmart occurs just across the road from the well and may conceal some Deaton.

Several undeveloped or only partially used springs in the Newala discharge large quantities of ground water of suitable quality for a variety of industrial uses.

Deaton Spring (5GGS4) discharges up to about 15 mgd. However, due to leakage from the main enclosure, the amount of readily available water may be as little as 6 mgd. The spring is located on the south bank of Euharlee Creek just south of the Aragon-Taylorsville road, about two and a half miles northeast of the center of Aragon. It is about a quarter of a mile west of the Seaboard Coast Line Railroad. For year-round use, provisions to protect the spring from flooding by the creek will be required; but as the water discharges from a large cave, it may be possible to tap it while underground, thereby eliminating the need for improvements. A sample of the spring water had a total hardness of 132 ppm and an iron content of 0.09 ppm.

Davitte Spring (5GGS3) discharges about 2.3 mgd from the west bank of Euharlee Creek, a few feet below the Aragon-Taylorsville road, about 2 miles northeast of the center of Aragon. The spring is high enough above the creek to escape most floods, but will require protection from surface water off the road. A sample of the water had a total hardness of 134 ppm and an iron content of 0.08 ppm.

West Spring (3FFS1), about 4 miles southwest of the center of Rockmart, is only a few hundred feet south of U. S. Highway 278 and about the same distance from the Seaboard Coast Line Railroad. It discharges about 1 mgd, but as it is a pool spring and on the valley floor, will require considerable improvement to exclude surface water. Water sampled from the spring had a total hardness of 6 ppm and an iron content of 0.05 ppm.

Hoyt Beck Spring (4GGS3), on the west bank of Fish Creek half a mile south of U. S. Highway 278 and beside the Seaboard Coast Line Railroad, in 1950 discharged about 1 mgd. At present the flow is less than half that amount, but the reduced volume seems to have resulted from clogging of the spring by debris. Cleaning the spring probably will restore the flow. Water from the spring had a total hardness of 87 ppm and an iron content of 0.06 ppm.

Several other springs discharge from the Newala in Polk County, but their flows are less than 0.3 mgd. Most of these currently are being used for domestic or stock supplies.

Lenoir Limestone

In Polk County the Newala Limestone is succeeded by as much as 35 feet of limestone of Middle Ordovician age that includes two distinct lithologies, herein tentatively correlated with the Lenoir Limestone and its Mosheim Member. The Lenoir Limestone was named by Safford and Killebrew (1876) from Lenoir City, Loudon County, Tenn., and the Mosheim Member was named by Ulrich for the town of Mosheim, Green County, Tenn.

The Lenoir Limestone in Polk County is composed of medium to dark gray, finely crystalline to aphanitic limestone that is thickly to massively bedded where fresh, but upon weathering breaks down into thin slabs and nodular pieces. Some layers of the Lenoir contain a profusion of poorly preserved, largely fragmental fossil material; others are barren of fossils. *Maclurites* sp. occurs sparingly throughout much of the limestone and locally is abundant. Several specimens of *Maclurites* sp. were collected from the beds of Lenoir that crop out along the north shore of the small lake that lies just south of the rock quarry, 2.0 miles north-northeast of the center of Rockmart and 1.0 mile east of Georgia Highway 101 (U.S.G.S. Colln. No. 4128-CO).

Mosheim Member

The Mosheim Member, which occurs at different levels within the Lenoir, is mainly light to medium-gray, generally aphanitic limestone, though some is finely crystalline. Except where it is highly cleaved, the Mosheim is massively bedded and, unlike the Lenoir, remains so during weathering. Two unusual features of the Mosheim set it apart from most limestone in the area. One is its tendency to develop a thick chalky crust where it weathers beneath a soil cover. The other is the presence of abundant small, clear calcite crystals scattered throughout the aphanitic groundmass. The only other limestone in the area containing crystals of this type are a few aphanitic layers of the Newala Limestone.

Much of the Mosheim is very fossiliferous. Limestone long exposed at the surface commonly exhibits cross sections of calcareous gastropods, and rock recently uncovered from beneath a soil layer may have calcareous gastropods protruding from its surface or preserved in a chalky crust. Numerous gastropods were collected from the limestone lying along the north side of the large quarry (now filled with water) that is beside Georgia Highway 101, just north of Rockmart. Dozens of gastropods were taken from the pinnacles of Mosheim that were exposed by iron mining, 2.1 miles north-northeast of the center of Rockmart and 1.1 miles east of Georgia Highway 101 (U.S.G.S. Colln. No. 4128-CO). This collection included *Loxoplocus (Lophospira)* sp., *Liospira* sp. or possibly badly mashed *Clathrospira*, *Clathrospira* sp.,? *Raphistoma* sp., *Trochonema* sp., and *Helicotoma* sp. (see plate 2).

The gastropods taken from the Lenoir Limestone and its Mosheim Member have been distorted by cleavage and pressure, so that even the best cannot be identified to species level. However, Yochelson states that collectively this fauna definitely is later than Early Ordovician and, as it underlies the Rockmart Slate, necessarily is of Middle Ordovician age.

Distribution.—The Lenoir Limestone has been recognized in the vicinity of Rockmart, Aragon, and Taylorsville, Polk County. Limestone immediately beneath the Rockmart Slate south of Cedartown exhibits cross sections of high spired gastropods and probably is Lenoir. *Helicotoma* sp. collected near Oremont indicates that the formation is present on the west side of the county.

The Lenoir is well exposed in the large quarry at Portland and at several places along the base of ridges made up by Rockmart Slate. Isolated outcrops occur beside the Aragon-Taylorsville road. Several feet of Lenoir Limestone remain along the north rim of the quarry beside Georgia Highway 101, just north of Rockmart. The limestone also is well exposed in and near the quarry about 2 miles north-northeast of the center of Rockmart.

Utilization.—Until the 1950's, when the quality requirements became more stringent, the Lenoir was extensively used in the manufacture of cement. A large quantity of the limestone was removed from the quarry beside Georgia Highway 101, just north of Rockmart. The formation there is preserved in an overturned or faulted northeast trending syncline. Quarrying began on the northwest limb of the syncline, and followed the formation down dip.

The Lenoir presently is being quarried, along with the Rockmart Slate, about 2 miles north-northeast of the center of Rockmart. The limestone and slate are on the north limb of the same syncline.

A large quantity of Lenoir, along with the Newala Limestone, was taken from the big quarry at Portland and used to make cement.

The most recent attempt to develop the Lenoir for use in cement production was made in the valley about 1.5 miles north of Aragon. An exploratory opening there revealed that the formation is about 25 feet thick and it is covered by nearly 20 feet of overburden. The limestone was found to be too thin for quarrying by itself, and the underlying Newala is too dolomitic to use.

The Lenoir Limestone 1.5 miles north of Aragon occupies an unusual structural position. It underlies the floor of a valley and is nearly horizontal, yet it is flanked on the east and west by fairly high ridges of older Newala Limestone. The latter dips away from the valley in both directions, suggesting that the Lenoir forms the core of an anticline, and this fact has led some workers to conclude that the Lenoir was a lower part of the Newala. In fact, however, the Lenoir has been faulted downward on both sides in a graben.

Prospecting for a suitable quarry site in the Lenoir is complicated by the fact that the formation varies so greatly in thickness. At the Deaton mine, for example, the formation is absent, whereas at Portland, a mile and a half away, it is about 35 feet thick. Even though the limestone is known to be present at most places at the base of the Rockmart Slate, exposures generally are so poor that its thickness cannot be determined without exploratory drilling. Furthermore, the overlying slate normally creates a prohibitive amount of overburden.

Away from the main body of the Rockmart Slate, the Lenoir is preserved in appreciable thicknesses only in synclines or where, until recent times, it was protected from solution by a covering of slate. Thus, the limestone generally is associated with outliers of Rockmart, as it is in the quarry about 2 miles north-northeast of the center of Rockmart.

Hydrology.—The Lenoir Limestone is so thin that wells generally penetrate it and derive water from the underlying Newala. A few wells beginning in the Rockmart Slate obtain 5 to 10 gpm from limestone close below, possibly from the Lenoir.

Deaton Member

The Lenoir Limestone locally is overlain by varying thicknesses of iron-rich rocks herein named the Deaton Member of the Lenoir Limestone. The Deaton rests variously on the Lenoir, its Mosheim Member, or in the Deaton iron mine where these two have been eroded, directly on the Newala Limestone. The name Deaton originally was applied to these rocks by Spencer (1893, p. 83) because they were well exposed in the Deaton iron mine, about 2 miles west of Taylorsville. Spencer included the Deaton within the Newala Limestone (his Chickamauga Limestone) and correlated it with the iron ore at about the same stratigraphic position in Whitfield County, Ga., and with Safford's (1869) iron limestones of Tennessee. Hayes (1902) considered the Deaton to be in the lower part of the Rockmart Slate.

Lithology and distribution.—The Deaton Member has been recognized only in a relatively narrow zone of eastern Polk County near Rockmart and Taylorsville. It occurs as isolated exposures within this small area, and its character varies greatly from one outcrop to another, especially across the strike; thus the unit is assigned member status.

At the Deaton mine, one of its more westerly exposures, the Deaton consists of more than 100 feet of dark-gray to nearly black calcareous ore in beds 0.5 to 4 feet thick, some of which contain about 30 percent iron. Much of the ore is magnetic, due to a high magnetite content. Decalcification and oxidation produce pieces of dark-brown limonitic ore and deep red hematitic ore that accumulate in a thick red sandy clay soil. Some of the ore has a high sand and silt content and weathers to brown and red ferruginous sandstone and siltstone.

Interbedded with the highly ferruginous beds are layers of conglomerate made up of pebbles and a few cobbles of dolomite, limestone, some sandstone and siltstone, and small pieces of dark shale, in a matrix of ferruginous, chlcareous feldspathic sandstone. A high percentage of the pebbles are siliceous dolomite that, in weathered rock, leave a residue resembling pisolites or oolites. Round voids in the rock are left by solution of the limestone pebbles. The pebbles apparently were derived mainly from the Newala and the Lenoir Limestones, and the Knox Group, which were uplifted and subjected to erosion during the time the Deaton was being deposited.

Ore of the Deaton Member has been mined from pits about 2 miles northeast of the center of Rockmart where, as recently as 1955, the iron was used in the manufacture of cement. No fresh ore is exposed there but the deep red soil contains scattered pieces of brown, red, and yellowish argillaceous and feldspathic sandstone and siltstone. Some of these pieces contain spherical silt and clay inclusions that appear to be the remains of siliceous dolomite pebbles similar to those occurring in the rock at the Deaton mine; other pieces include spherical hollows that probably contained limestone pebbles. Pinnacles of the Mosheim Member are exposed in the bottom of the pits northeast of Rockmart and show that the Deaton at this locality was deposited on slightly younger limestone than it was at the Deaton mine. These workings are near what Hayes' map (1902) shows as the settlement of Red Ore, and it seems likely that the red ore here may be what Hayes (1902, p. 3) referred to as being in the lower part of the Rockmart Slate. The Rockmart is present only a short distance to the east.

About 5 miles east of the Deaton mine, near the Polk-Paulding County line, the Newala Limestone is succeeded by medium to very coarse grained, feldspathic quartzite, sandstone and quartz-pebble conglomerate, at least 25 feet thick but probably much thicker. The massively bedded quartzite forms a prominent ridge between the Newala Limestone and the Rockmart Slate. Similar outcrops occur close to the Bartow-Paulding County line about a mile farther northeast. Although the quartzite has a character very different from the limestone in the Deaton mine, its stratigraphic position indicates that it is correlative with the Deaton Member.

Just south of U. S. Highway 278 about 2¾ miles southeast of Van Wert, the Deaton consists of medium-grained rusty-weathering sandstone and quartzite, probably about 10 to 20 feet thick, that does not seem to be especially ferruginous. It rests on the Newala or possibly some Lenoir Limestone, and seems to be immediately overlain by the Rockmart Slate, although the upper contact is not exposed.

Spencer (1893, p. 169) states that the Deaton also occurs about 1.75 miles northeast of the center of Rockmart and 0.75 mile southeast of Van Wert, but the writer did not find exposures there. Spencer also reported an occurrence of the Deaton a mile southeast of Van Wert, but this deposit of ferruginous material is very small and as it occurs well up in the Rockmart Slate, it does not appear to be related to the Deaton.

Fauna and age.—The few fossils known from the Deaton Member are fragmentary and poorly preserved. Those found all came from the Deaton mine (abandoned), south of the paved road about 2 miles west of Taylorsville, Polk County (U.S.G.S. Colln. No. 6700-CO). A sample of brown, ferruginous rock taken from the south edge of the mine contained shell fragments that G. A. Cooper, U. S. National Museum, identified as probably a linguloid brachiopod. Also present in the rock were 2 poorly preserved conodonts that John W. Huddle questionably referred to *Drepanodus*, a genus common in the Ordovician but known from the Cambrian and probably occurs in younger rocks.

The fossils suggest that the Deaton was an estuary deposit laid down in brackish water.

The stratigraphic position of the Deaton between the Lenoir Limestone and the Rockmart Slate shows that it is of Middle Ordovician age.

Hydrology.—The Deaton Member is so thin and occurs so sporadically that it has little importance as an aquifer. Wherever the Deaton might yield water, it should be cased off to prevent contamination of the supply by iron.

Rockmart Slate

The Rockmart Slate of Middle Ordovician age was named by Hayes (1891, p. 143) for the town of Rockmart, Polk County, Ga., near where the slate is exposed in several quarries. The Rockmart unconformably overlies the Newala and Lenoir Limestones and locally the Deaton Member of the Lenoir. It is succeeded unconformably by the Armuchee Chert or the Frog Mountain Sandstone in western outcrops, and by the Fort Payne Chert and possibly some Armuchee Chert in eastern outcrops. The name Rockmart Slate as used in this report has been adopted by the U. S. Geological Survey.

The type section of the Rockmart Slate is along the Seaboard Coast Line Railroad beginning in the south part of Rockmart and continuing southeastward across U. S. Highway 278 and about 1 mile beyond that highway to the upper contact of the formation with the Fort Payne Chert. This section includes 2 separate exposures of the lower part of the Rockmart. One is in the south part of the town of Rockmart, and the other is between Van Wert and where the railroad crosses U. S. Highway 278. The upper part of the Rockmart is exposed intermittently along the railroad east of U. S. Highway 278.

One reference section for the Rockmart Slate is along the Southern Railway east of Rockmart, where slate of the lower part and sandstone, slate, and conglomerate of the upper part of the formation are exposed in cuts. Another reference section is along the unpaved road going east out of Van Wert to Braswell. This road crosses hills and ridges made up of both the lower and the upper parts of the Rockmart.

Lithology.—The Rockmart consists chiefly of clay and silt slate but it also includes large quantities of nonfissile siltstone, sandstone, and conglomerate. The slate forms a broad sheet of fairly uniform thickness that extends essentially unbroken across the entire outcrop belt of the formation. The sandstone, siltstone and conglomerate form a wedge, thickest to the southeast, that overspreads the slate as far west as Cedartown.

The most common type of slate in the Rockmart, and the one dominating the lower part of the formation, is dark-gray to nearly black, calcareous, fairly pure clay slate. It has well developed cleavage on the eastern side of the county, especially near Rockmart, and moderate cleavage in most other areas. Upon exposure, the slate first becomes lighter gray; some of it then alters to tan or yellowish brown, commonly with an orange tint, and finally to pink. Other weathers to greenish or light olive gray, then to tan, and finally to pink, the latter type being most common on the west side of the outcrop belt. The weathered slate breaks down into soft, very thinly laminated waxy flakes. Slate of this type is abundantly displayed across the entire outcrop belt and can be observed in numerous quarries and prospect pits.

Another important constituent of the Rockmart is argillaceous and micaceous siltstone. Some of the siltstone is thickly bedded and has a uniform tan color. Some other is made up of 1/8 inch to 1/2 inch thick beds of slightly differing composition that weather to various shades of brown and yellow, giving the rock a fine color banding. Some siltstone has poorly developed cleavage and splits into slabs about a quarter of an inch thick, but most tends to remain massive and does not separate into layers, either along cleavage or the bedding. The highly weathered rock disintegrates into small irregularly shaped pieces.

Siltstone is well displayed beside the unpaved road three-quarters of a mile northwest of the intersection of Georgia Highway 100 and U. S. Highway 27.

The sandstone in the Rockmart is light to medium gray and ranges in grain size from very fine to very coarse. The grain size increases from west to east across the county, although both fine- and coarse-grained varieties are present in most areas. Bedding likewise tends to thicken toward the east. Near Rockmart some beds reach a thickness of more than 6 feet, whereas in the Cedartown area they generally are less than 1 foot thick, though beds 3 or 4 feet thick do occur. As a rule, the sandstone is interbedded with slate or conglomerate so that unbroken thicknesses of sandstone rarely exceed 10 feet.

Nearly all of the sandstone in the Rockmart is feldspathic, which sets it apart from other formations in the area except the Frog Mountain Sandstone. The weathered rock is tan to rusty brown and has an interior flecked with cream-colored or light-brown inclusions remaining from the weathered feldspar.

Sandstone is well exposed along the Seaboard Coast Line Railroad southeast of Van Wert. Uncommonly thick-bedded sandstone crops out at the top of the large cut on the Southern Railway about

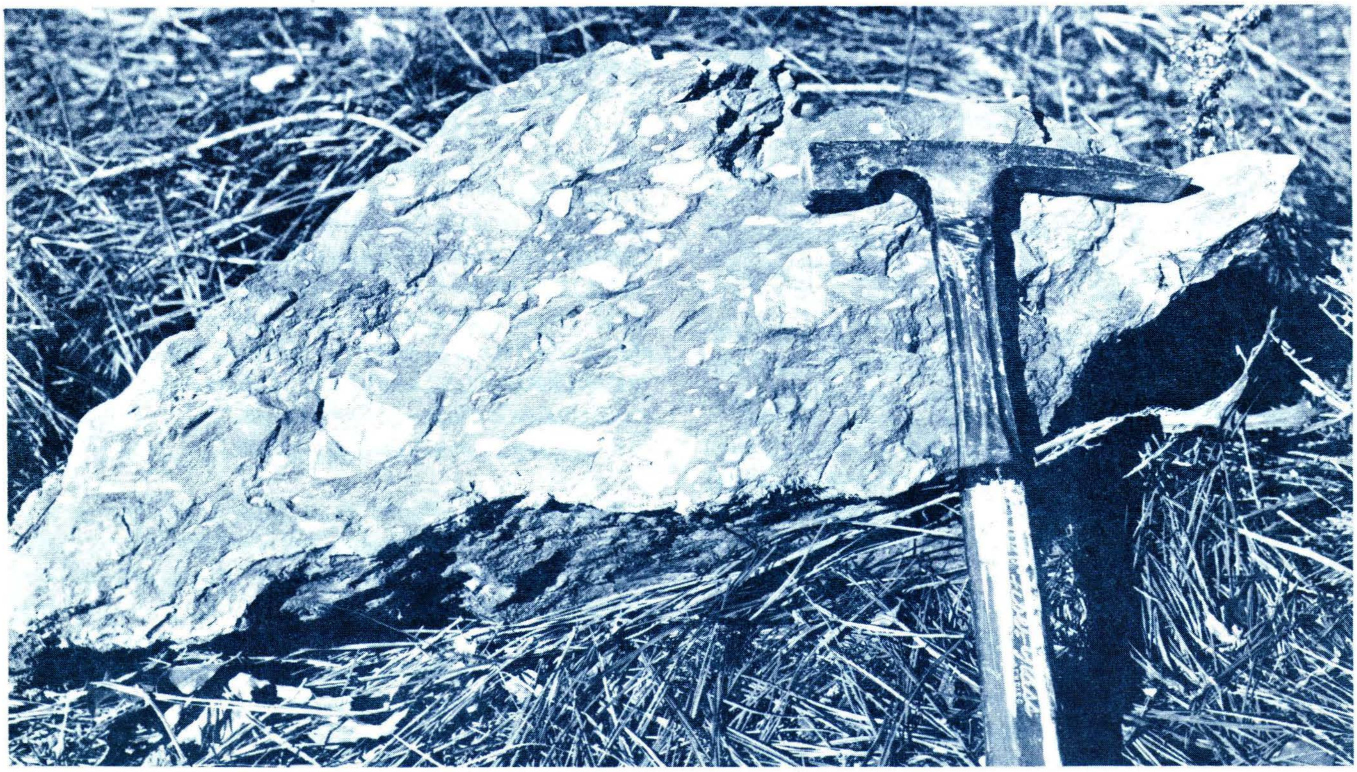

Figure 6. Conglomerate in the Rockmart Slate.

2 miles east of Rockmart. It occurs at several places along the unpaved road going east out of Rockmart toward Braswell, and crops out on the east flank of Signal Mountain, and on several ridges south and east of Rockmart.

Conglomerate in the Rockmart consists of several types. One of the most wide spread types is made up of pebbles and cobbles of limestone, dolomite, slate, sandstone, chert, and both sedimentary and metamorphic quartzite, generally in that order of abundance, incorporated in a matrix of feldspathic sandstone (fig. 6).

The pebbles and cobbles are composed of material derived from older Paleozoic formations and some transported by streams from the Piedmont. Most of the limestone and dolomite can be recognized as coming from the Newala and Lenoir Limestone and the Knox Group. Still other dolomite is similar to that of the Shady Dolomite. Reddish sandstone from the Rome Formation is present, as is quartzite and sandstone from the Rome or possibly from the Weisner Quartzite. The chert probably came from the Knox Group and the Newala Limestone. Some of the sandstone and shale is reworked Rockmart. Other conglomerates are composed of pebbles of essentially the same material but have a matrix of sandy slate, graywacke, clay slate, or rarely dolomite or limestone.

Weathering dissolves the carbonate from the conglomerate leaving layers of rusty-brown sandstone or other matrix material pocked with rounded hollows.

Outcrops of the above types of conglomerate are not numerous in the Cedartown area. One good exposure, although several hundred feet from the road, can be seen on the south side of the ridge, about three-quarters of a mile southwest of the intersection of U. S. Highway 27 and Georgia Highway 100.

Several conglomerate beds are exposed in the broad expanse of the formation south of Grady. One is beside the unpaved road near the crest of a low ridge, about half a mile northwest of Antioch School.

Another type of conglomerate in the Rockmart is composed of fine quartz pebbles in a matrix of feldspathic sandstone. It is exposed near the top of the formation along Georgia Highway 100, south of the junction with U. S. Highway 27.

The conglomerate bodies are lenticular and rarely extend more than a few hundred feet in any direction before pinching out or grading into sandstone or conglomeratic slate. The pebbles and cobbles probably were brought in by streams and dumped into a shallow sea where they accumulated near shore. The conglomerate lenses in the south easternmost outcrops are thickest and have the widest lateral extent. They also contain the coarsest and the least rounded pebbles and cobbles, apparently having been deposited nearest the source area.

Conglomerate outcrops are numerous near Rockmart. Several are present on the north slope and near the crest of the ridge about 2 miles southwest of the center of Rockmart. Conglomerate is prominently displayed along the Seaboard Coast Line Railroad east of the overpass on U.S. Highway 278. It also occurs in the cut of the stream flowing just west of U. S. Highway 278, at the curve 0.4 mile south of the same overpass. Thick beds of sinuously folded conglomerate have been uncovered in the large cut of the Southern Railway 2 miles east of Rockmart. Conglomerate having a dolomitic matrix occurs beside the road that runs along the south side of Lake Dorene, south of Rockmart. Conglomerate is present on the east slope of Signal Mountain and in the valley east of the mountain.

The pebbles and cobbles in most exposures of the conglomerate have been greatly elongated parallel to the cleavage, so that their diameter prior to deformation is difficult to determine. In the Cedartown area most of the pebbles appear to have been between 1 and 2 inches in largest dimension mixed with only a few small cobbles. South of Grady, pebbles were about the same size and the cobbles were as much as 4 inches across. In the Rockmart vicinity, pebbles also occurred, but the cobbles which were far more abundant, ranged from 3 to 6 inches in greatest dimension and a few were nearly a foot across.

Distribution.—The Rockmart extends for a distance of about 30 miles along the southern and eastern margins of the unaltered Paleozoic rocks in Polk County, expanding into large areas south of Cedartown and Gray, in the vicinity of Rockmart, and between there and Taylorsville. Two isolated outcrops also occur in the adjacent part of Bartow County. Middle Ordovician slate in Cherokee

County, Ala., was included within the Rockmart Slate by Hayes (1894, p. 472), but it currently is considered part of the Athens Shale by the Geological Survey of Alabama.

Age of the Rockmart Slate.—Geologists long have disagreed over the exact age of the Rockmart. Beginning with his earliest work in Georgia, Hayes (1891, 1902) assigned the Rockmart to the Ordovician (Silurian of his day) and correlated it with the upper part of the Chickamauga Limestone north of the Coosa Fault. Spencer (1893), Veatch (1909), and McCallie (1910) in general agreed with Hayes, but Ulrich (1911) assigned the Rockmart to the Lower Ordovician Blount Group (upper Chazy) of former usage and correlated it with the Athens Shale of Tennessee. Maynard (1912) followed Hayes' thinking and LaForge (1925) showed the Rockmart as Middle Ordovician in age, but does not indicate whether it includes any Lower Ordovician. Butts and Gildersleeve (1948), on the other hand, placed the Rockmart in the Mississippian System, correlating it with the Floyd Shale, and it is shown as that age on the geologic map of Georgia (Cooke and others, 1939).

This lack of agreement among geologists concerning the exact age of the Rockmart developed because fossils from this formation were unknown except to early workers. According to Robert A. Laurence (oral communication, 1964), who found the information recorded in a field notebook, graptolites were discovered near the base of the Rockmart in 1890 by M. R. Campbell while he assisted Hayes in mapping the Rome and Tallapoosa quadrangles. For some reason, though, the find was not reported, and later workers were unaware of Campbell's discovery. Fossils were not again reported from the Rockmart until the present investigation.

Although Butts and Gildersleeve (1948, p. 53) reported finding fossils of Mississippian age in the Rockmart, these fossils now are known to have come from the Fort Payne Chert. The fossils Butts collected were in chert exposed in the road metal pits beside Georgia Highway 100, half a mile south of the junction with U. S. Highway 27. The chert is steeply dipping, and it is underlain and overlain by slate and sandstone of similar character. Butts identified the slate above and below the chert as Rockmart, and therefore concluded that the chert and the slate were part of the same formation Indeed, the slate beneath the chert is Rockmart, but that above it belongs to the Floyd Shale of Mississippian age. The fossils Butts found came from the Fort Payne Chert which overlies the Rockmart Slate.

Fauna.—During the present investigation, several hundred graptolites were collected from the Rockmart Slate throughout its entire outcrop belt. The fossils came from clay slate, silty slate and nonfissile siltstone. On the western side of the county, where the formation is mostly slate, the graptolites are found to be fairly well distributed throughout the entire section. In the Grady and Rockmart areas, on the other hand, they are limited to the lower half or so of the formation and in every instance occur below the sandstone-conglomerate-shale sequence which constitutes the middle and upper parts. The possible significance of this fact is discussed later in the section on correlation of the Rockmart.

Graptolites were collected exhaustively from nine localities in Polk County. The species obtained from each locality (table 4) are listed and discussed collectively in the text, and some are pictured in plate 1. In addition, graptolites were collected from one place in the Athens Shale of Murray County, Ga., to determine possible correlations of the Athens Shale and the Rockmart Slate; these are listed under locality number 10. Graptolites collected by Preston E. Cloud, Jr., from the Athens Shale of Cherokee County, Ala., shown as locality number 11, are listed and discussed collectively in the text.

William B. N. Berry identified the graptolites and made all of the age determinations. The zone numbers used are those of Berry (1960).

Locality number 1:
From slate just below sandstone and chert at northwest end of small upper dam at Elders Lake.
Climacograptus cf. *C. riddellensis* Harris
Climacograptus n. sp. (of the type of *C. marathonensis*)
Cryptograptus schaferi Lapworth
Glyptograptus aff. *G. teretiusculus* var. *siccatus* (Ellis and Wood)
Retiograptus ? sp.
Age: Middle Ordovician—in the interval of Zone 10
(*Glyptograptus teretiusculus* Zone) into Zone 12
(*Climacograptus bicornis* Zone)—proba-

bly the *Glyptograptus teretiusculus* Zone (Zone 10).

Stratigraphic position: This collection is from the top of the formation.

Locality number 2:

From silty slate in the spillway at the southeast end of small upper dam at Elders Lake.

Cryptograptus tricornis (Carruthers)
dichograptid fragments
Glossograptus sp.
Glyptograptus euglyphus (Lapworth)
Glyptograptus aff. *G. euglyphus* var. *sepositus* (Keble and Harris)

Age: Middle Ordovician—in the span of Zone 9
(*Hallograptus etheridgei* Zone) to Zone 12
(*Climacograptus bicornis* Zone)—probably Zone 10
(*Glyptograptus teretiusculus* Zone)

Stratigraphic position: This collection may be from the middle or upper part of the formation but this is uncertain due to the close proximity of faulting.

Locality number 3:

From slate and shale about 30 feet east of unpaved road at curve, 3.06 miles east of Old Brewster School and 0.65 mile southeast of Pine Bowers Church.

Climacograptus cf. *C. riddellensis* Harris
Climacograptus cf. *C. scharenbergi* Lapworth
Climacograptus n. sp. (like *C. marathonensis*)
Climacograptus sp.
Cryptograptus tricornis (Carruthers)
Didymograptus cf. *D. paraindentus* Berry
Didymograptus cf. *D. tornquisti* Reudemann
dichograptid fragments
Glossograptus ciliatus Emmons?
Glossograptus hincksii (Hopkinson)
Glyptograptus euglyphus (Lapworth)
Glyptograptus euglyphus cf. var. *sepositus* (Keble and Harris)
Glyptograptus cf. *G. teretiusculus* (Hisinger)
Glyptograptus aff. *G. teretiusculus* (Hisinger)
Glyptograptus cf. *G. teretiusculus* var. *siccatus* (Ellis and Wood)
Retiograptus sp.

Age: Middle Ordovician—Zone 10 (*Glyptograptus teretiusculus* Zone)

Stratigraphic position: The position of this collection in the formation is uncertain but it probably is in the lower half.

Locality number 4:

From slate in ditch on north side of unpaved road, 3.1 miles east of Old Brewster School and 0.75 mile southeast of Pine Bowers Church.

Climacograptus riddellensis Harris?
dichograptid fragments
Glossograptus sp.
Glyptograptus aff. *G. euglyphus* (Lapworth)
Glyptograptus sp.
Hallograptus inutilis (Hall)
Isograptus sp. (of the *I. caduceus* type)

Age: Middle Ordovician—in the interval of Zone 9
(*Hallograptus etheridgei* Zone) to Zone 10 (*Glyptograptus teretiusculus* Zone)

Stratigraphic position: Located very close to fault, so position is uncertain.

Locality number 5:

From slate exposed in the ditch on the west side of the paved road 4.9 miles south-southwest of the center of Cedartown and 0.6 mile south of Pine Bowers Church, 100 to 200 feet south of locality number 8.

Climacograptus riddellensis Harris
Climacograptus aff. *C. riddellensis* (Harris)
dichograptid fragments
Didymograptus cf. *D. robustus* var. *norvegicus* Berry MS
Glossograptus sp.
Glyptograptus euglyphus (Lapworth)
Glyptograptus sp.
Pterograptus n. sp. (similar forms occur in the Australian Darriwil *Glyptograptus teretiusculus* Zone)
Retiograptus aff. *R. speciosus* Harris

Age: Middle Ordovician—Probably Zone 10 (*Glyptograptus teretiusculus* Zone) - although it might be Zone 9 (*Hallograptus etheridgei* Zone).

Stratigraphic position: Uncertain.

Locality number 6:

From siltstone on the north bank of the unpaved road 3.10 miles south-southwest of the center of Cedartown and 0.72 mile northwest of the intersection of U. S. Highway 27 and Georgia Highway 100.

Glyptograptus euglyphus

Glyptograptus cf. *G. teretiusculus* var. *siccatus* (Ellis and Wood)

Age: Middle Ordovician—in the interval of Zone 9 *(Hallograptus etheridgei* Zone) to Zone 11 *(Nemagraptus gracilis* Zone) - possibly Zone 10 *(Glyptograptus teretiusculus Zone)*

Stratigraphic position: Middle of formation.

Locality number 7:

From silty slate on the north side of the operating slate quarry just north of the Seaboard Coast Line Railroad, in the southern part of Rockmart. This is the locality in which M. R. Campbell made the original discovery of graptolites in the Rockmart Slate in 1890.

Climacograptus sp. (of the *C. riddellensis* type)

Glossograptus sp.

Glyptograptus euglyphus (Lapworth)

Age: Middle Ordovician—in the interval of Zone 10 *(Glyptograptus teretiusculus* Zone) to Zone 12 *(Climacograptus bicornis* Zone).

Stratigraphic position: Lower part of the formation.

Locality number 8:

From highly weathered slate beneath layers of chert in the west cut of the paved road at the intersection with the dirt road, 4.9 miles south-southwest of the center of Cedartown and 0.5 mile south of Pine Bowers Church. (U.S.G.S. Colln. No. D1092-CO).

Glyptograptus euglyphus (Lapworth)

Climacograptus cf. *C. scharenbergi* Lapworth

Trigonograptus sp.

Glyptograptus sp.

Glyptograptus aff. *G. teretiusculus* (Hisinger)

Glyptograptus ? sp.

Glyptograptus ? sp. or possibly *Orthograptus* ? sp.

Glyptograptus cf. *G. euglyphus* var. *sepositus* Harris and Keble

Climacograptus sp. (of the *C. angulatus* Bulman type)

Hallograptus cf. *H. mucronatus* (Hall)

Cryptograptus schaferi Lapworth

Retiograptus sp.

Age: Middle Ordovician—*Nemagraptus gracilis* Zone (Zone 11) possibly - though it might be *Glyptograptus teretiusculus* Zone (Zone 10) or as young as *Climacograptus bicornis* Zone (Zone 12).

Stratigraphic position: Upper part of formation, probably at the top.

Locality number 9:

From slate in cut of unpaved road 5.50 miles southwest of the center of Rockmart and 4.20 miles south of U. S. Highway 278 (U.S.G.S. Colln. No. D1093-CO.).

dichograptid fragment

Climacograptus aff. *C. riddellensis* Harris

Glossograptus sp.

Glyptograptus euglyphus (Lapworth)

Glyptograptus cf. *G. teretiusculus* (Hisinger)

Glyptograptus euglyphus (Lapworth)

Age: Middle Ordovician—probably *Glyptograptus teretiusculus* Zone (Zone 10) - this age is based on the joint occurrence of a *Climacograptus* of the *C. riddellensis* type with glyptograptids of the *G. teretiusculus* and *G. euglyphus* kinds. The total age span possibly could be as young as Zone 12 *(Climacograptus bicornis* Zone).

Stratigraphic position: near the base of the Rockmart.

Locality number 10:

From the Athens Shale, Murray County, Ga., at or near the base, just off the west slope of Sumack Ridge, 7.0 miles slightly west of north from the center of Chatsworth, 1.5 miles west of the east edge of the Dalton quadrangle, and 1.25 miles east of the Cleveland Road (U.S.G.S. Colln. No. D1371-CO).

Glyptograptus aff. *G. teretiusculus* var. *siccatus* (Ellis and Wood)
dichograptid fragment
Glyptograptus sp.
Glyptograptus ? sp.
Glyptograptus aff. *G. teretiusculus* (Hisinger)
dichograptid fragment
Glyptograptus cf. *G. teretiusculus* (Hisinger)
Glyptograptus cf. *G. euglyphus* (Lapworth)
Retiograptus cf. *R. speciosus* Harris
[This specimen is identical to some from a highest Darriwil age locality (*Glyptograptus teretiusculus* Zone) in Victoria, Australia.
Retiograptus sp.
Climacograptus cf. *C. riddellensis* Harris
Climacograptus n. sp. (of the *C. marathonensis* type)
dichograptid fragment and *Cryptograptus* ? sp. biserial scandent form?

Age: Middle Ordovician—*Glyptograptus teretiusculus* Zone (Zone 10) probably - although the age might be as young as the *Climacograptus bicornis* Zone (Zone 12). Again, the joint association of climacograptids like *C. riddellensis* with *G. teretiusculus* and *G. euglyphus* kinds of glyptograptids and a *Retiograptus* like *R. speciosus* strongly suggest a Zone 10 age interpretation.

Stratigraphic position: at the base of the Athens Shale.

According to Berry this collection appears to be slightly older than, or possibly the same age as Collection D1092-CO from the Rockmart Slate. It is probably the same age as Collection D1093-CO from the Rockmart Slate.

Locality number 11:

Collected by P. E. Cloud, Jr., from the Athens Shale in Cherokee County, Ala., on the west bank of the paved road 0.88 mile southwest of the highest elevation of Frog Mountain near the west edge of the Rock Run and vicinity, Ala.-Ga. quadrangle.

Climacograptus sp. (thecae like those of *C. luperus*)
Climacograptus sp. (a slender form with thecae like those of *C. riddellensis*)
Didymograptus? sp.
Glossograptus sp.
Glyptograptus cf. *G. euglyphus* (Lapworth)
Glyptograptus sp.

Age: Middle Ordovician—in the interval of Zone 9 (*Hallograptus etheridgei* Zone) to Zone 12 (*Climacograptus bicornis* Zone) at a guess - Zone 10 (*Glyptograptus teretiusculus* Zone) based on the association of climacograptids with pouched thecae with *Glyptograptus* cf. *G. euglyphus.*

Stratigraphic position: apparently near the top of the Rockmart; near the contact with overlying chert.

Regarding collections from localities 1 through 9, Berry states, "Those collections that include more than two or three forms seem to come from Zone 10. Climacograptids like *C. riddellensis* which have deeply pouched thecal excavations and a zig-zag suture appear initially in Zone 10 in North America—and at a correlative position in Australia. Their association with retiograptids which are similar to the Australian highest Darriwillian retiograptids, *Glyptograptus euglyphus*, and small forms of the *Glyptograptus teretiusculus* type strongly suggest a Zone 10 age assignment. The collections in which two or more of these occur together (Locality numbers 1 through 7 and 11) are probably all of Zone 10 age. Because stratigraphic ranges of graptolites in the southern Appalachians are not well known, and because the precise diagnostic association of Zone 10 is also not well known, the age interpretation of the collections is open to some question and thus the possible age span for each has been noted. The correlation of Zone 10 with the brachiopod Stage sequence is not certain, but I suggest about an Ashby correlation." Berry is referring to the Ashby Stage of Cooper (1956).

Graptolites collected thus far show that the lower part of the fossiliferous Rockmart Slate falls in the interval of Zone 9 to Zone 10, and probably is Zone 10. The middle and apparently most of the upper part are in the interval of Zone 10 to Zone 12, and probably are of Zone 10 age, as well.

The uppermost beds of the Rockmart at one locality south of Cedartown yield graptolites believed to be of Zone 11 age.

Correlation.—Assuming that the age assignments given the graptolite assemblages prove correct in light of further collection, the bulk of the fossiliferous part of the Rockmart is slightly younger than the Deepkill Shale (Early and Middle Ordovician) of New York, but is older than the Athens Shale (Middle Ordovician) at Athens, Tenn. Only the uppermost part of the Rockmart carrying Zone 11 fossils is correlative with the Athens Shale in Tennessee, or with the Athens Shale south of Birmingham, Ala., which Cooper (1956, p. 57) has named the Columbiana Formation.

A collection of graptolites (locality 10) from the basal beds that have been mapped as Athens Shale in Murray County, Ga. (Butts and Gildersleeve, 1948), and called a southern extension Paperville by Cooper (1956, p. 53), is in the range of Zone 10 to Zone 12. Berry believes they may be Zone 10 or that they possibly may be Zone 11. If the Zone 10 age proves correct, the base of the so-called Athens Shale in Murray County, Ga., is the same age as the Rockmart; if it is Zone 11 age, the shale is the same age as the Athens Shale of Tennessee.

Slate cropping out over a broad area of Cherokee County, Ala., initially was mapped as Rockmart by Hayes (1894, p. 472), but more recently it has been considered as Athens Shale (Butts, 1926; Cloud, 1967). Graptolites taken from near the top of the slate by P. E. Cloud, Jr., about 10 miles west of Polk County, show that it falls in the interval of Zone 9 to Zone 12, and Berry believes it is Zone 10. If so, the slate is the same age as the Rockmart Slate, but is older than the Athens Shale farther southwest in Alabama. Because the slate is physically continuous with and lithologically identical to the Rockmart, it should be considered part of the Rockmart.

The lower, predominantly slaty part of the Rockmart, beginning near Cedartown in Polk County, is overlain by an eastward thickening wedge of clastics, composed largely of sandstone, conglomerate, and conglomeratic slate. The clastics consitute a mappable unit, and where sufficiently thick, are delineated on the accompanying geologic map, but they are included in the Rockmart for want of fossil evidence to determine their exact age.

It is the writer's belief, however, that as the clastics at the top of the Rockmart form a distinct lithologic unit, they should be separated from the Rockmart and designated as a formation. The conglomerate and sandstone in the unit are remarkably similar to those in Murray County, Ga.,mapped by Butts and Gildersleeve (1948) as the Tellico Formation, and by Salisbury (1961) as the Chota Formation. The conglomerate is nearly identical to that in the Tellico Formation in Georgia and in Tennessee described by Kellberg and Grant (1956). Further investigation may provide evidence for correlating the clastics at the top of the Rockmart with at least part of the sandstone-conglomerate-shale sequence mapped as Tellico and Chota in Murray County, Ga.

Thickness.—In Polk County, the Rockmart ranges in thickness from 0 to about 600 feet. East of Van Wert, where it contains the largest amount of clastic material, the formation attains a maximum thickness of between 400 to 600 feet. North and west of this area, as the proportion of clastic material decreases, the Rockmart thins to between 200 and 300 feet and remains about that thick across the county to the Alabama line near Esom Hill. At Etna, where the Rockmart re-enters Polk County from Alabama, it is between 200 and 300 feet thick, but it thins toward the east, diminishing to about 20 feet at Oremont, and it is absent a quarter of a mile southeast of there, apparently having been eroded off an anticline that formed prior to deposition of the Frog Mountain Sandstone of Early and Middle Devonian age.

It is interesting to note that past workers have considered the Rockmart's thickness to be far greater than 600 feet. For example, Spencer (1893) showed it to be 1,200 feet thick and Butts and Gildersleeve (1948) gave its thickness as 3,000 feet. It is not known how they arrived at these estimates, but it seems possible they may have been influenced by the pseudostratification produced by cleavage on the slate and conglomerate southeast of Van Wert where the Rockmart is a mixture of slate, limestone-pebble conglomerate, and a little sandstone, and the entire section is steeply folded. Compressional forces have greatly stretched all of the conglomerate pebbles and oriented their long axes parallel to the dip of the cleavage in the slate. The elongated pebbles and the slaty cleavage are parallel and inclined steeply to the east, so that where they are viewed in limited cross section, as in the shallow cuts of the Sea-

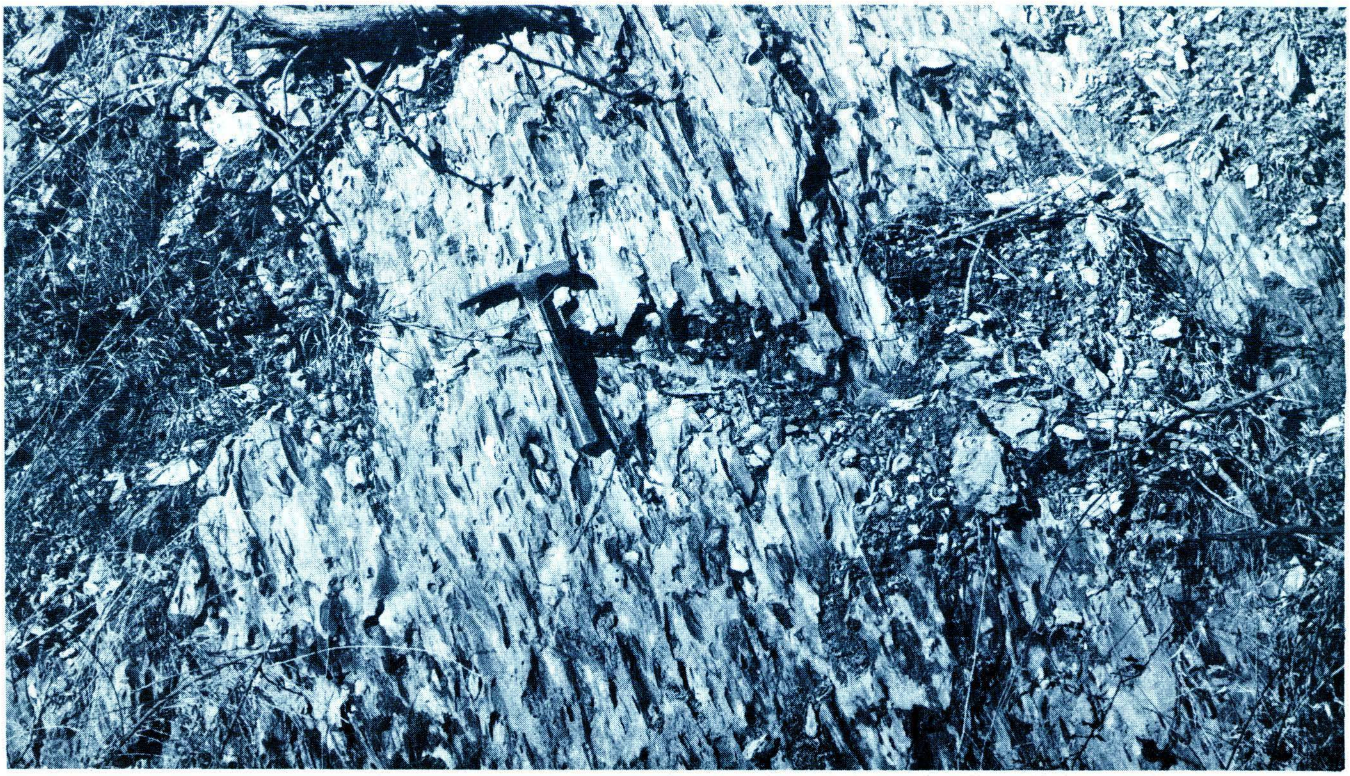

Figure 7 Conglomerate layer in the Rockmart Slate showing pebbles stretched with long axes parallel to dip of cleavage.

board Coast Line Railroad east of U. S. Highway 278, they have the appearance of successive bedding (fig. 7). This apparent stratification is exposed for thousands of feet across the strike and conveys the impression that the formation has great thickness.

An examination of the thin sandstone beds present in the section, however, reveals that the formation along the railroad track is folded and that the same beds of conglomerate and slate are repeated several times. The apparent stratification is solely the result of cleavage (fig. 8).

A similar sequence of slate, sandstone, and conglomerate is exposed in the big cut of the Southern Railway 2 miles east of Rockmart. In this cut the conglomerate pebbles also are stretched and have their long axes oriented parallel to the dip of the cleavage in the slate, but because the cut is high and the sandstone beds are thicker, it is easy to see that the formation is gently folded (fig. 9). The Rockmart as a whole is inclined at a shallow angle to the east approximately paralleling the dip of the formations above and below. Thus, the thickness of the Rockmart is reflected fairly accurately by the corrected vertical distance separating the Newala and Lenoir Limestone below the Rockmart and the Fort Payne Chert that overlie it. At most, this distance is about 600 feet.

Hydrology.—Thirty wells inventoried in the Rockmart Slate vary in depth from 26 to 198 feet with an average depth of 98 feet. Yields are reported to range from about 1 gpm to 30 gpm with most wells supplying between 5 and 15 gpm.

The water varies from soft to hard depending on the location and the depths of the wells. In general, the quality is satisfactory for home use although eight well owners reported their water had an objectionably high iron content. Six of these wells are wholly within the Rockmart, but the other two are close to the edge of its outcrop and probably pass through the slate into the limestone below. They may derive iron from the highly ferruginous Deaton Member of the Lenoir Limestone which occurs at that level. Water from one well in the Rockmart (3FF25) had a total hardness of 105 ppm and an iron content of 2.6 ppm. A sample from well 3FF34 had an iron content of 0.79 ppm, and a total hardness of 398 ppm.

The Rockmart is the only formation in the study area that yields water having a high noncarbonate hardness.

The one well inventoried that clearly derives water from the upper sandstone part of the Rockmart yielded about 2 gpm. Other wells beginning in the sandstone are deep enough to pass through it and obtain water from the underlying slate; their yields tend to be higher. Well 5FF9, which is 150 feet deep, is estimated to yield about 10 gpm, and a sample of the water had a total hardness of 32 ppm and an iron content of 1.1 ppm.

Other Formations of Ordovician Age

In Floyd County, the Ordovician System includes representatives of four or possibly five formations. They are too thin to be shown individually on a geologic map of the scale used with this report (fig. 4) and are shown as a single unit.

According to Butts and Gildersleeve (1948, p. 31), the Moccasin Limestone makes up the main body of rock in the Ordovician System in Floyd County. A more detailed study indicates, however, that only a small part of the section belongs to the Moccasin; the remainder is correlative with other formations of Middle Ordovician age: the Murfreesboro Limestone, the Ridley Limestone, and the Bays Formation. Good exposures of these formations can be seen on Horseleg Mountain; some of them crop out on the west slope of Simms Mountain, around Heath Mountain, and on Lavender Mountain.

Lithology, distribution, and fauna.—Near the southwest end of Horseleg Mountain, the two limbs of the mountain are connected by a saddle. About 100 feet south of this saddle the Copper Ridge Dolomite is unconformably overlain by 30 or 40 feet of rock that resemble a part of the Murfreesboro Limestone, common farther north in the State (Butts and Gildersleeve, 1948, p. 23). The Murfreesboro consists of calcareous mudstone, yellow at the base, but grading upward into pink and finally into red mudstone flecked with yellow.

About 600 feet southwest of the saddle, the lower yellow mudrock of the Murfreesboro apparently is replaced by about 50 feet of fairly pure limestone. The limestone rests on the Copper

Figure 8. Beds of sandstone in Rockmart Slate showing divergence of bedding and cleavage.

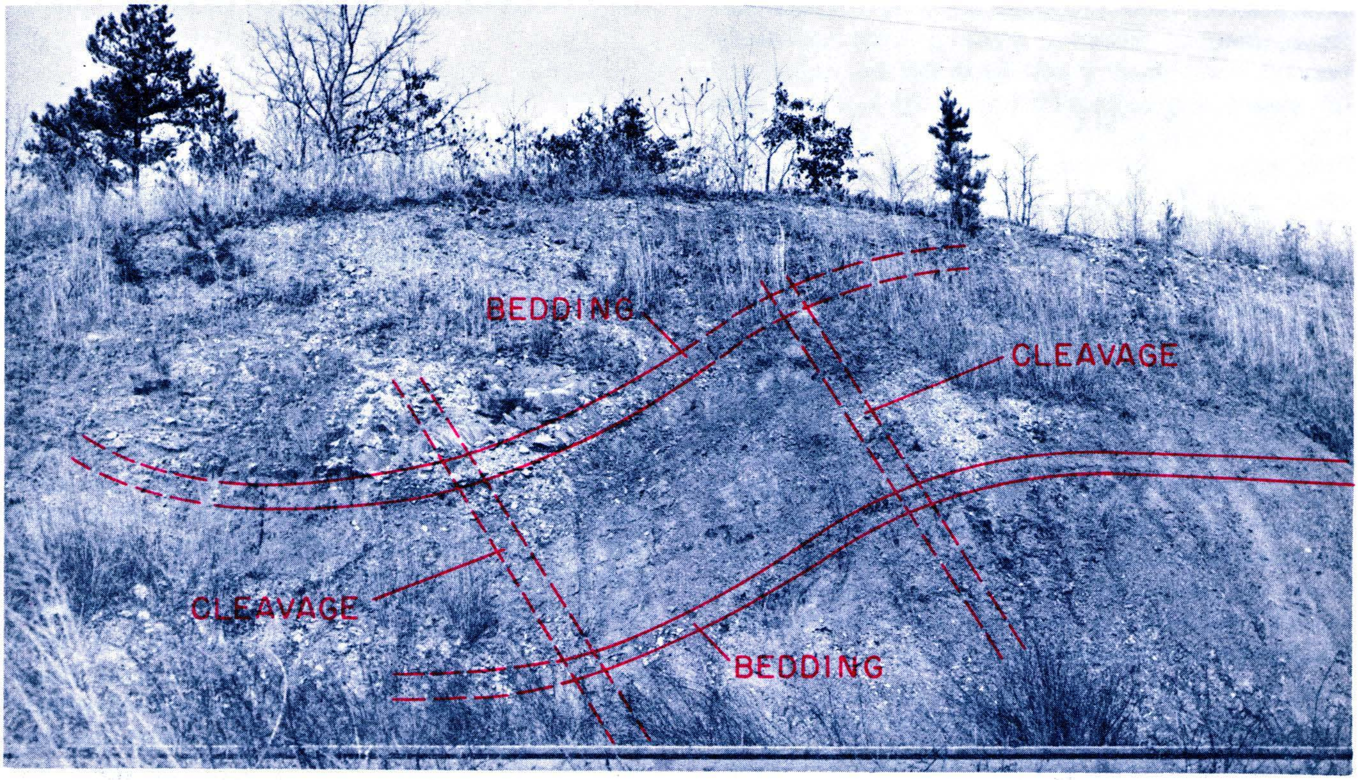

Figure 9. Cuts of the Southern Railway 2 miles east of Rockmart showing folded sandstone beds in Rockmart Slate.

Ridge Dolomite and is overlain by red mudrock that, as far as exposures reveal, is continuous with the red mudrock near the saddle. The limestone is light to medium gray, thickly to massively bedded, and aphanitic to finely crystalline. Locally it displays pink and green clouding. Fossils in the rock are limited to cross sections of calcified gastropods, so identifications could not be made. The general character of the stone, however, and particularly the pink and green clouding, is suggestive of both the Newala Limestone and the Murfreesboro Limestone in Catoosa and Walker Counties, Ga.

On the south side of the saddle that separates the two limbs of Horseleg Mountain, and about 30 feet above the Upper Cambrian-Middle Ordovician boundary, the mudrock of the Murfreesboro is overlain by several feet of cobbly pink and yellowish-green argillaceous limestone containing specimens of a brachiopod (see plate 2, fig. 2a-c) identified by Robert B. Neuman as *Rostricellula variabilis* Cooper (U.S.G.S. Colln. No. 4425-CO). Cooper (1956, p. 654) reported this variable species in Georgia only from the *Fascifera* bed of Ridley Limestone, and according to Neuman this collection may have come from the same level, but associated fossils should be collected and studied to confirm this correlation. Unfortunately none were found. A few very poorly preserved low-spired gastropods (*Maclurites ?*) occur slightly higher in comparatively pure blue-gray flaggy limestone that forms the top of the saddle.

Succeeding the flaggy limestone in the saddle is about 100 feet of maroon and some yellow, shale and calcareous silty mudstone, mixed with thin-bedded reddish siltstone and fine- to medium-grained sandstone. Also present is a little pink and red and, rarely, blue impure limestone. This section probably is correlative with the Moccasin Limestone as suggested by Butts and Gildersleeve (1948, p. 31).

The remaining 300 feet of the Ordovician include lithologies that correspond closely to the Middle Ordovician Bays Formation, and may include some Sevier Shale and possibly rocks of Upper Ordovician age. The sequence is composed of yellow, maroon, and reddish shale and calcareous mudstone, thin-bedded red siltstone, and impure fine to very coarse grained sandstone. The middle and upper parts include beds of light gray rather clean quartzite that are thin bedded and finer grained below, becoming very massively bedded and coarser grained toward the top. Some quartzite layers are conglomeratic, containing rounded quartz pebbles as much as a quarter of an inch across. A 5-foot layer of altered volcanic ash occurs near the middle of the unit; it is exposed in the west ditch of the road on top of Horseleg Mountain a little less than a mile southwest of the fire lookout tower.

The basal beds of Ordovician rocks on Horseleg Mountain are separated from the underlying Knox Group by a major unconformity. This unconformity is marked by a bed of conglomerate from 6 inches to about 2 feet thick composed of rounded and angular pieces of detrital chert ranging from sand size to about half an inch in greatest dimension, cemented by a matrix of mudstone or limestone. The matrix is identical to material forming the basal bed of the succeeding Middle Ordovician formation.

The detrital chert forming the conglomerate bed represents reworked chert that accumulated on the weathered surface of the Knox Group after it was elevated above sea level and subjected to erosion, prior to resubmergence and deposition of the younger formations. This conglomerate is correlative with the Attalla Conglomerate which is widespread in Alabama (Butts, 1926, p. 121) and also well-developed in southern Chattooga County, northwest Georgia. The Attalla Conglomerate also occurs in western Floyd County where in one place it is thick enough to be shown on the accompanying geologic map, figure 4, thus herein, is given formational rank in Georgia.

Ordovician strata also crop out in Furnace Valley in northernmost Floyd County, but the formations present there were not determined.

Hydrology.—This part of the Ordovician section probably will be of little use as an aquifer in most areas because it underlies steep, deeply dissected slopes. The steep slopes cause a rapid runoff and correspondingly low recharge; the deep dissection results in rapid loss of water through leakage.

Red and yellow mudrock and some sandstone appear at the surface in relatively flat-lying areas west and north of Heath Mountain and in Furnace Valley. Wells in depressions there can be expected to supply 2 to 10 gpm, depending on the amount of sandstone present. The water will be soft to moderately hard and may be high in iron.

Silurian System

Red Mountain Formation

The Red Mountain Formation of Silurian age was named by Smith (1876) for developments on Red Mountain east of Birmingham, Ala. The formation is an important source of iron ore in Alabama and has been worked on a moderate scale in Georgia.

Lithology.—The Red Mountain is composed of sandstone, shale and conglomerate. The base of the formation consists of about 100 feet of medium-gray coarse-grained sandstone, quartzite, and quartz-pebble conglomerate. Grains in the sandstone and quartzite are medium to very coarse, subrounded and subangular, and are fairly well sorted. The conglomerate is composed of well-rounded pebbles as much as 0.6 inch in diameter thinly scattered, but locally concentrated, in a matrix of medium and coarse-grained sand. Some layers of conglomerate contain pebbles of limonite or clay as much as 0.8 inch across, which weather out leaving smooth-sided hollows in the rock surface. Bedding in the basal unit is massive, generally ranging between 4 and 6 feet thick.

The middle part of the formation is composed of sandstone and shale in approximately equal proportions. The sandstone is medium to coarse grained, brown weathering, and most is in layers 2 to 4 feet thick. The sandstone layers which weather to a rusty brown are separated by varying thicknesses of dark-gray clay and silt shale that weathers to olive green or tan.

In the top 300 feet to 400 feet of the formation, the sandstone is mainly very fine to fine grained and occurs in beds from a few inches to about 2 feet thick. The sandstone beds are separated by varying thicknesses of shale.

The changing character of the Red Mountain from bottom to top is well displayed on the crest of Turkey Mountain. The top of the formation and its contact with the Armuchee Chert occur near the south end of the mountain; the basal conglomerate crops out a short way from the north end.

Distribution and thickness.—In Floyd County, the Red Mountain Formation is between 600 and 1,200 feet thick. Because it is very resistant to erosion, it upholds the highest ridges in the county, including Horseleg, Turkey, Johns, Lavender, Turnip, Simms, and Heath Mountains.

Partial sections of the Red Mountain can be seen beside the Central of Georgia Railway at the west end of Lavender Mountain, along the road over Lavender Mountain about a mile northeast of Lavender Station, and beside the roads ascending and on top of Horseleg Mountain. The basal quartzite unit of the formation crops out in the cut of Georgia Highway 20 at the east end of Heath Mountain.

So far as the writer is aware, the Red Mountain does not crop out south or southeast of the Rome Fault. Spencer (1893, p. 86) identified the sandstone and quartzite on the ridges southwest of Cedartown, Polk County, as Red Mountain but these rocks intertongue with chert and without much doubt belong to the Frog Mountain Sandstone.

With the possible exception of the 3 or 4 feet of quartzite immediately above the Rockmart Slate at Elders Lake (described under Frog Mountain Sandstone) no indication of the Red Mountain was found in Polk County.

Hydrology.—So far as was learned, the Red Mountain is not used as an aquifer in the report area. Its outcrops are so high and remote that only Horseleg Mountain, which is conveniently close to Rome, is inhabited; the homes there are supplied water by a private distribution system.

Studies of the Red Mountain in other counties of the state show that in flat areas near a stream, or on gentle slopes near the base of a ridge, wells can be expected to yield between 2 and 10 gpm. In a few places where recharge is constantly available such as beside a stream that crosses the formation, a well may supply between 5 and 20 gpm. Such conditions exist in Floyd County where Cabin Smith Creek crosses the formation between Turnip and Lavender Mountains and in a few places along the south slope of Lavender Mountain, mainly near the northeast end. It may be possible to obtain a satisfactory supply in a few places on the southeast flank of Horseleg Mountain. In general though, the availablilty of ground water in the Red Mountain seems to be low. This is because most of the ridges upheld by the Red Mountain in Floyd County are high, narrow crested, and steep sided and are formed by strata inclined from 30 to 90 degrees. As these conditions do not favor recharge or storage, the occurrence of an adequate and dependable supply of ground water in the formation will be rare, and the chance of obtaining a domestic well on the summit of most of the ridges is very poor.

One exception to this is Lavender Mountain which, because it is an anticline, for most of its length has a relatively broad crest that is underlain by nearly horizontal strata. Because of its breadth, the ridge is covered by fairly deep soil and this, coupled with the nearly flat bedrock should provide adequate recharge and storage, so that wells drilled in flat, low areas should supply between 2 and 10 gpm.

Water from the Red Mountain generally is soft, but it commonly has an objectionably high iron content. The concentration of iron in some of the water is so high that filtration is needed to make it potable and keep it from ruining porcelain fixtures.

In the past 3 years a need has arisen for ground water supplies in the Red Mountain Formation on Horseleg Mountain; people want to build homes on the northwest limb of the mountain, but the area is beyond the reach of the private distribution system. Wells are the suitable source of water and the Survey, in cooperation with the Georgia Department of Mines, Mining and Geology, has been called in to aid in selecting well sites.

Unfortunately, along this limb of the mountain, water seems to be in very short supply. The underlying rocks are steeply inclined to the northwest and because of this, the ridge generally is only 100 to 300 feet wide and slopes off abruptly to the east and west. Due to the narrowness of the ridge, erosion has kept soil accumulation to a minimum and the lack of an absorptive soil cover results in high runoff, so that little water finds its way into the bedrock. Furthermore, water reaching the bedrock is lost rapidly through leakage down the slanting bedding planes. It is this combination of low rate of recharge and rapid loss of water from storage that severely limits the quantity of ground water available in the Red Mountain along this part of Horseleg Mountain.

It may be possible to develop a satisfactory home supply at a few places along the ridge where undulations in the structure have left relatively low dipping strata. Where the dips are gentler the ridge crest tends to be broader and have a thicker soil cover that is conducive to recharge. The most favorable conditions for finding water exist where a local drainage has cut a depression in a broad part of the ridge crest toward which ground water will migrate from at least two directions. A well positioned in the lower part of such a drainage probably stands some chance of tapping a year-round supply.

Devonian System

Frog Mountain Sandstone

The Frog Mountain Sandstone of Devonian age was named by Hayes (1894, p. 470) for Frog Mountain, Cherokee County, Ala. There the formation is about 300 feet thick and consists of fine- to coarse-grained red-weathering sandstone in the upper part, and sandy calcareous and cherty beds and dolomitic limestone in the lower part. In Alabama, the Frog Mountain has yielded many fossils of Middle Devonian (Onondaga) age (Butts, 1926, p. 157).

Lithology and thickness.—The Frog Mountain Sandstone appears to be a clastic facies of the Armuchee Chert; the two formations commonly intertongue and the Frog Mountain in many places includes beds and nodules of chert. In the report area the Frog Mountain is approaching its northeastern and eastern limits and therefore is very thin. In much of Floyd County it is present only as a thin layer within the Armuchee Chert.

The Frog Mountain in Floyd County varies from about 5 to as much as 25 feet thick and is made up of light- to medium-gray, fine- to medium-grained sandstone and vitreous quartzite that contain a high percentage of granular feldspar. The quartz grains are subrounded and subangular and commonly are frosted. Upon weathering, the rock becomes reddish brown and is speckled by rust-colored hollows formerly filled with feldspar. Locally the Frog Mountain is highly ferruginous and its outcrops have been extensively prospected for iron.

In Polk County, outcrops of the Frog Mountain are scattered over a wide area south and southwest of Cedartown, but good exposures occur only in a few places. One is in the cut of the lower dam of Elders Lake. The Frog Mountain there is as much as 15 feet thick and consists mainly of light- to medium-gray, fine-grained feldspathic quartzite containing scattered quartz pebbles as much as a quarter of an inch in diameter. The quartzite weathers to light brown or medium dark brown. The upper 2 or 3 feet of the formation are light-gray to dark-gray quartzite that is outstandingly different from that below, because its weathered surfaces are white and vitreous. In this exposure, the Frog Mountain rests unconformably on the Rockmart Slate and is overlain by the Fort Payne Chert, but faulting has repeated the sequence three times and the formation has a different thickness in each fault slice.

On the ridges around Elders Lake and in the valley immediately southeast of the lower dam, the Frog Mountain consists of light- to medium-gray, fine- to coarse-grained quartzite. Most of the rock has a rounded nearly white vitreous surface, similar to the upper quartzite at the dam, and is unusually hard and flinty like the quartzite on and near Indian Mountain. The nearly white surface of the quartzite is separated from the darker interior by a rusty-brown or reddish-brown layer 0.1 inch to 0.25 inch thick. Bedding ranges from about 1 inch thick, chiefly in the lower part, to several feet thick near the top of the Frog Mountain. The lower thinner bedded layers tend to be less vitreous and softer than the more massive upper layers. Small quantities of thinly bedded chert are intercalated with the quartzite, particularly on the ridges north and east of Elders Lake and at one place, the quartzite is separated from the Rockmart Slate by about 10 feet of very dark gray chert containing abundant molds of crinoid stems. The presence of this chert in and beneath this quartzite was the principal reason for correlating the quartzite with the Frog Mountain rather than with the Red Mountain Formation, as was done by Spencer (1893, p. 86).

About a mile southwest of Elders Lake, in the cut made for the dam of Cupps Pond, the exposed Frog Mountain is composed of a lower 2.5-foot layer of quartzite, which rests on the Rockmart Slate, and an upper 1-foot layer of quartzite, separated by 2.5 feet of olive-green to very dark gray sandy, cherty material containing poorly preserved cup corals. The quartzite is fine to very coarse grained, highly ferruginous, and contains scattered quartz pebbles about 0.2 inch in diameter. Preserved on the rusty-brown surface of the weathered quartzite are faint impressions of cup corals and very large (3-inch) brachiopods and pelecypods. The thickness of the quartzite exposed in the cut changes abruptly. Within the cut of the dam the quartzite layers change in thickness abruptly, largely as a result of folding and duplication by faulting, and in the spillway the section is repeated several times.

From Cupps Pond westward toward Esom Hill the Frog Mountain increases in coarseness and becomes interbedded with, and in places overlies, a few feet of thinly to thickly bedded chert (Armuchee). West of Esom Hill, though, the chert disappears and is replaced by dark-gray to nearly black shale and slate that is unique in the area because it weathers to a very light gray. About a mile west of the state line in Alabama, the amount of shale increases and locally it is more abundant than the quartzite but farther west and northwest the quartzite again predominates and the shale is confined mainly to the lower part of the formation.

The other outcrop area of the Frog Mountain in Polk County is at Etna and Oremont. Immediately east and north of Oremont the formation consists of 20 to 30 feet of light-gray to dark-gray, brown-weathering quartzite and sandstone containing granular feldspar. Chert layers and nodules occur sparingly throughout much of the rock as do poorly preserved gastropods, crinoid stem plates, and various fossil debris.

In the mine on the side of the ridge, about a quarter of a mile southeast of Oremont, the Rockmart Slate is absent and the Frog Mountain rests unconformably on the Newala Limestone. Pieces of dolomite from the Newala, along with chert nodules, possibly from the same source, are incorporated in the basal quartzite layers of the Frog Mountain.

About half a mile southwest of Oremont, the Frog Mountain attains a thickness of perhaps 100 feet and forms a sizable ridge. There the formation consists of fine- to coarse-grained vitreous quartzite that on exposed surfaces has a nearly white chert-like surface similar to the quartzite on the ridge near Elders Lake. Quartz pebbles as much as 0.25 inch across occur in some layers. The interior of the rock is light gray to pink where slightly weathered and is flecked with cream-colored feldspar grains. Further weathering softens the rock and changes it to a rusty brown. As can be seen in nearby mines, the Frog Mountain at this location overlies at least 25 feet of Armuchee Chert and perhaps as much as 20 feet of Rockmart Slate.

About a mile west-southwest of Oremont massive light-gray quartzite of the Frog Mountain caps a narrow ridge where it overlies a thin section of the Armuchee Chert (formerly mistaken for chert of the Knox Group) and, where that is absent, rests on the Rockmart Slate.

Farther west on Etna Mountain and on Indian Mountain, the formation has increased in coarseness and much of the sandstone and quartzite are conglomeratic. Its thickness was not determined, but on Etna Mountain it probably is between 200 and 300 feet, and on Indian Mountain it is much thicker.

Distribution.—In Floyd County, the Frog Mountain is limited to a layer of quartzite 5 to 20 feet thick contained within the Armuchee Chert. It is exposed in the cut of the paved road that goes up the northeast end of Horseleg Mountain and in the cut of the Central of Georgia Railway at the southwest end of Lavender Mountain. The formation also crops out at several places along the east slope of Turkey Mountain, where it is highly ferruginous and has been extensively prospected for iron.

In Polk County, the Frog Mountain occurs in several widely separated areas. It is present on the crests and slopes of several ridges in the vicinity of Elders Lake and extends from there to the ridges southwest of Cedartown. The formation makes up a prominent ridge west and southwest of Oremont, and is exposed in the mines east and north of Oremont. It crops out locally on the slopes of the hills of the Knox Group east and south of Oremont and Etna. As best as could be determined, the Frog Mountain makes up the lower part of Indian Mountain.

Fauna and correlation.—Although fossils are rare in the Frog Mountain, enough were found to clearly establish that the formation is younger than Early Ordovician, and in view of its stratigraphic relations, there is little doubt that it is of Devonian age.

Weathered Frog Mountain in the spillway of Cupps Pond contains faint impressions of solitary corals and 3-inch brachiopods and pelecypods. Cherty material in the cut of the dam also contains poorly preserved solitary corals, some of them revealing internal structures.

From weathered sandstone of the Frog Mountain in the mine half a mile north of Oremont, Yochelson and Cressler collected a spiriferoid brachiopod that, although it was generically indeterminate, clearly is of post-Ordovician age. Some molds, possibly of pelmatozoan debris, also were present in the rock containing the brachiopod. In the same mine, other sandstone and quartzite of the formation display faint impressions of gastropods and very small crinoid stem plates.

As these were the only places fossils were found, mapping the Frog Mountain in isolated areas around Indian Mountain in Polk County and adjacent Alabama was done solely on the basis of lithologic correlation and stratigraphic position. For this reason, the identification of the rock on the south slopes of Indian Mountain should be considered tentative, until further work can be done to locate some fossils.

From Cupps Pond, where it is fossiliferous, the Frog Mountain forms a nearly continuous ridge that crosses into Alabama and swings northwestward and finally northeastward to re-enter Georgia near Etna. The formation is especially interesting in this part of Alabama because it develops an unusual character. For example, on Wheeler Hill, Cleburne County, and Baker Hill, Cherokee County, Ala., the Frog Mountain includes a large amount of extremely well-sorted quartzite and sandstone that is unlike anything present in other formations in the area. The rock is composed either of light-gray or of dark-gray quartz grains, depending on the location, that are well rounded, spherical, and frosted. Approximately 75 percent of the grains are in the 1-2 mm grade size (Crawford, 1957, p. 42). Most of the rock is cemented by quartz, but some layers have a matrix of light-gray-weathering, dark-gray clay. The coarser grained quartzite is so distinctive that it locally is known as "birdshot conglomerate" or "frogs-egg conglomerate" (Crawford, oral communication, 1965).

Rock composed of such highly sorted spherical grains is unique in the area and, therefore, is a valuable aid in correlating the Frog Mountain in the absence of fossils. It also is helpful in distinguishing the Frog Mountain from Weisner Quartzite; according to John Rodgers (oral communication, 1964), who saw it in the cut of Alabama Highway 74 about a mile west of the Georgia line, this type of rock does not occur in the Weisner Quartzite. The Weisner is the only formation in the area that contains quartzite easily confused with that in the Frog Mountain.

From Baker Hill the Frog Mountain, including numerous layers of "birdshot conglomerate" and a lower section of light-gray-weathering shale, extends northward to an unnamed ridge south of the abandoned mining town of Bluffton and on to Bluffton Mountain. From there it swings eastward, part of the outcrop crossing a broad valley and extending up on the south slope of Indian Mountain, and the remainder continuing into Georgia where it makes up Etna Mountain and some lesser ridges at Oremont.

Where it makes the swing from Esom Hill into Alabama, and back into Polk County at Etna, the Frog Mountain crops out around the nose of a large anticline in the Knox Group. The Frog Mountain is in normal sequence from the Knox up through the Newala Limestone and the Rockmart Slate, and so far as exposures reveal, the sequence remains normal to the south base of Indian Mountain. As Crawford determined (1957), Indian Mountain is a faulted synclinorium, and the strata on the south slope of the mountain are stratigraphically above the formations in the valley, rather than below them as formerly was supposed (Hayes, 1902).

Hydrology.—No hydrologic data were available for the Frog Mountain Sandstone as its outcrops are uninhabited. But, judging by other largely sandstone aquifers, the formation can be expected to supply as much as 20 gpm to wells. The amount of water available will depend largely on the formation's thickness and the attitude of its beds.

In Floyd County, and in Polk County from Elders Lake to Esom Hill, where the Frog Mountain averages less than 20 feet thick, wells in low areas favorable for recharge probably will supply between 2 and 10 gpm. The formation is steeply inclined over most areas though, and will be beyond the practical reach of wells except in a narrow belt paralleling its outcrop. An exception to this occurs near Cupps Pond where the bedding has a low dip and the formation probably lies at a shallow depth over a wide area.

Between Cupps Pond and Esom Hill, the formation includes considerable bedded chert which may increase the availability of water. South of Esom Hill, the Frog Mountain is faulted over by the Rockmart Slate which may act as a confining layer to produce artesian conditions.

Near Oremont, the thickness of the formation increases to as much as 100 feet. In the thicker parts wells on gentle slopes probably will yield 5 to 20 gpm. The rock dips at a shallow angle beneath the valley and should provide a good source of water over a wide area.

On Indian Mountain large quantities of ground water may be available where deeply intrenched stream valleys cross the outcrop. The rock receives nearly constant recharge from surface water and ground water traveling down gradient along the stream courses, and should be capable of meeting large withdrawals by wells. Yields of 50 gpm or more may be possible. The wells would have to be positioned far enough upstream to be above a thick section of sandstone.

Water from the Frog Mountain probably will be soft, but it will tend to have a moderate to high iron content.

No springs of appreciable size are known in the Frog Mountain. A few very small springs seep from the base of Indian Mountain and at least one is used for a stock supply.

Armuchee Chert

The Armuchee Chert of Early and Middle Devonian age was named by Hayes (1902, p. 3) for exposures near Armuchee, Floyd County, Ga. The type section presumably is along and near Armuchee Creek where it crosses the end of Lavender Mountain.

Lithology.—The Armuchee is composed chiefly of medium to dark-gray chert that locally is sandy and ferruginous. In most weathered exposures it is light gray and where newly uncovered, it may have a rusty or reddish-brown surface. The chert normally is thin bedded although thick to massive beds generally occur, and in a few places the highly weathered chert largely is nodular. It is not unusual for the formation to contain scattered layers of ferruginous sandstone or very sandy chert which may or may not be feldspathic.

In Floyd County the middle and upper parts of the Armuchee commonly include a 5- to 25-foot unit of sandstone and quartzite that represents a northeastward extending tongue of the Frog Mountain Sandstone, a clastic counterpart of the Armuchee.

Distribution.—The Armuchee forms hogbacks along one or both flanks of the higher ridges of Red Mountain Formation and blankets the ends of the ridges that are anticlinal. Partial sections of the formation are exposed along the hogbacks where they are deeply dissected by local drainages. Better and more accessible outcrops occur along the paved road that crosses the northeast end of Lavender Mountain, three-quarters of a mile southwest of Armuchee; and along the Central of Georgia Railway at the opposite end of that mountain. The chert also crops out along the roads that ascend the northeast end of Horseleg Mountain and recently it has been uncovered in excavations made on the Shorter College campus in Rome.

Ten or more feet of the uppermost Armuchee are exposed in the cut of the paved road that crosses the south end of Turkey Mountain. Highly weathered Armuchee can be seen in the road metal pits on the west flank of Turkey Mountain near the north end, and steeply dipping layers of the formation, showing the massive character of the chert where it has weathered above ground, crop out on the hogback several hundred feet south of the road metal pits. On the east slope of Turkey Mountain, about midway between the north and south ends, the upper part of the Armuchee is exposed, along with the Chattanooga Shale and a thin section of Fort Payne Chert; here, the top few feet of the Armuchee are medium to coarse-grained sandstone containing an abundance of feldspar grains.

In Polk County, the Armuchee crops out on several ridges around Elders Lake and along the ridge that runs between Cupps Pond and Esom Hill. A 20-foot section of the formation is exposed in the mine about half a mile southwest of Oremont. Weathered chert of the Armuchee is scattered in abundance along the ridge half a mile west and northwest of Oremont.

Thickness.—As best as could be determined from incomplete exposures, in northern Floyd County, the Armuchee varies from about 100 to 150 feet thick and in the central part of the county it seems to range between 50 and 100 feet thick. The formation thins to the southwest and in Polk County it is only about 5 feet thick east of Elders Lake and perhaps as much as 30 feet thick on the ridge half a mile west of Oremont.

Utilization.—The Armuchee is an important source of road metal. Large tonnages of chert have been taken from pits on the west slope of Turkey Mountain.

The highly ferruginous sandstone at the top of the Armuchee on the east slope of Turkey Mountain has been prospected for iron but no commercial deposits were found.

Hydrology.—No wells were found that derive water solely from the Armuchee Chert. The Armuchee does, however, supply water to a high percentage of the wells that begin in the overlying Fort Payne Chert. The latter is so thin that wells pass through it and obtain water from both formations. For this reason, and because the formations are similar lithologically, the hydrologic properties of the Armuchee are discussed in the section of this report dealing with the Fort Payne Chert.

Chattanooga Shale

The Chattanooga Shale of Devonian and Mississippian age was named by Hayes (1891, p. 143) for exposures at Chattanooga, Tenn. The Maury Member of the Chattanooga Shale is of Early Mississippian age and was named for Maury County, Tenn. The Maury is designated a member of the Chattanooga in the area of this report.

Lithology and thickness.—In Georgia, the Chattanooga consists of as much as 40 feet of black highly fissile clay and silt shale, locally containing thin layers of siltstone and fine-grained sandstone. The Chattanooga gradually thins toward the south and in Floyd County it has a thickness of about 10 feet. Upon exposure, the shale slowly changes from black to brown and finally becomes purplish brown or tan; in highly weathered slate its appearance is similar to that of long-exposed Lavender Shale Member of the Fort Payne Chert.

Maury Member

The Maury Member, lying at the top of the Chattanooga, is a 2- to 3-foot layer of greenish glauconitic shale or clay. The Maury contains phosphatic nodules one-fourth inch to 6 inches in diameter, and as nodules of this type do not occur in other formations, they enable identification of the Maury where stratigraphic sequence is indeterminate.

In Floyd County the Maury is invariably at the top of the Chattanooga and thereby provides a valuable top and bottom criterion. In places such as the road intersection about 0.75 mile west of Armuchee, exposures are so poor that the attitude of the Chattanooga would be in doubt were it not for the Maury indicating the top.

Distribution.—The Chattanooga and the Maury have a line of outcrop along the dip slopes of all the ridges of Red Mountain Formation and they can be observed in the deeper drainage courses there: they are well displayed on the east flank of Turkey Mountain. Other exposures occur beside the road that runs along Armuchee Creek near the northeast end of Lavender Mountain; and along the roads ascending the northeast end of Horseleg Mountain. A good exposure of the Chattanooga is in the cut of Georgia Highway 20, at the south end of Turnip Mountain. Phosphatic nodules in the Maury are well developed in the southeast corner of the road intersection at the south end of Turkey Mountain.

Neither the Chattanooga nor the Maury has been recognized in Polk County and apparently they were not deposited there.

Hydrology.—The Chattanooga Shale is not an aquifer because it is thin and has very low permeability. It does, however, affect local ground-water conditions.

In parts of Floyd County where the Lavender Shale Member of the Fort Payne Chert is absent, the Chattanooga may act as a confining layer above the Armuchee Chert, producing artesian conditions. But more importantly, the Chattanooga contains sulfides; ground water that comes into contact with it generally becomes charged with iron and hydrogen sulfide. In addition, the shale contains small concentrations of uranium which may be picked up by the water. For these reasons, wells penetrating the Chattanooga either should be properly cased to a depth below the shale, or if they derive water from above and below, have the shale effectively cased off. Otherwise, good quality ground water from the Fort Payne Chert or the Armuchee Chert may be sufficiently mineralized to render the entire supply unfit for use.

Mississippian System

Fort Payne Chert

The Fort Payne Chert of Early Mississippian age was named by Smith (1890, p. 155-156) for development at Fort Payne, DeKalb County, Ala.

Stratigraphy.—The stratigraphic position of the eastward and southeastward extending tongues of Fort Payne Chert within Floyd County varies markedly with the location. At the south end of Turnip Mountain and the northeast end of Horseleg Mountain, for example, a thin section of Fort Payne immediately overlies the Chattanooga Shale. In north central Floyd County, on the other hand, the Fort Payne is separated from the Chattanooga by a considerable thickness of the Lavender Shale Member of the Fort Payne Chert. Large variations in position also take place within relatively short distances; on the east flank of Turkey Mountain, the Fort Payne succeeds the Chattanooga, whereas about a mile away, near the south end of the mountain, the Fort Payne lies more than 100 feet above the Chattanooga, at the top of the Lavender Shale Member of the Fort Payne Chert.

Lithology and thickness.—In all but the southernmost outcrops, the Fort Payne in Georgia consists of as much as 200 feet of thin- and thick-bedded chert, which seems to be the weathering product of highly siliceous carbonate. At any rate, on the west brow of Pigeon Mountain, Walker County, the only place where fresh exposures of the formation occur, the Fort Payne is thickly to massively bedded carbonate so siliceous that upon leaching it is reduced to thinly bedded chert without appreciable decrease in volume. East of Pigeon Mountain the formation undergoes a facies change, grading laterally into and becoming intertongued with calcareous shale and argillaceous limestone which Butts and Gildersleeve (1948, p. 44) named the Lavender Shale Member of the Fort Payne Chert.

In Floyd County where the Lavender Shale Member is well developed, the Fort Payne varies from as little as 10 feet to as much as 125 feet in thickness and is composed of light-gray to dark-gray chert in layers ranging from less than 1 inch to more than 2 feet thick. The chert beds are very even and extend for hundreds of feet without noticeable variation. Individual layers are separated by irregular bedding surfaces, commonly marked by very thin accumulations of silt and clay.

In Polk County, the Fort Payne assumes a varied character. In western outcrops it is largely bedded chert similar to that in Floyd County, mixed with silty, argillaceous, somewhat fissile, material like the Lavender Shale Member. Farther east the proportion of silty and argillaceous material increases and east of Rockmart, siltstone, fine-grained sandstone, and very silty and clayey chert form a major part of the Fort Payne. Indeed, much of the rock on the east side of the county that was mapped as Fort Payne would have been shown as Lavender had delineation been practical under the circumstances. It was decided for the sake of simplicity to map all of this rock as a single formation, because it is a continuous unit overlying the Rockmart Slate.

On the east side of the county nearly all of the chert in the formation is recrystallized, and the sandstone and siltstone grains commonly exhibit secondary growth. The rock there is light to medium gray, very hard, and has a vitreous surface. It tends to form rounded boulder-like chunks 2 to 6 feet across, and in places these are scattered about in abundance.

Along the extreme southeast edge of the outcrop, where intense pressure was brought to bear by the Cartersville Fault, the formation is brecciated. The breccia is made up of hard, angular pieces of light- to medium-gray recrystallized chert and siltstone mixed with softer, generally smaller and more rounded red, white, and tan pieces of similar material, all cemented into a mass by silica or iron oxide. Boulder-like chunks of breccia litter the ground surface and in many respects, the terrain resembles that underlain by the Attalla Conglomerate at the top of the Knox Group.

The silica cement, and in some places the iron oxide cement as well, is the most resistant part of the breccia, and as weathering progresses the rock surface becomes crisscrossed by silica and iron oxide protrusions that resemble box works. Where the iron oxide accumulates in unusual abundance, prospect pits have been opened, but no workable ore bodies have been uncovered.

On the ridge that extends north and northeast from the Seaborad Coast Line Railroad about 2 miles southeast of Van Wert, the basal Fort Payne either includes or overlies—exposures were too poor to be certain which—several feet of thinly bedded sandstone and quartzite that resembles the Frog Mountain Sandstone, as well as some of the sandstone in the Rockmart Slate. As its age could not be determined, the quartzite was mapped in the clastic unit of the Rockmart Slate. Further investigation may prove this quartzite to be Frog Mountain, or conceivably Red Mountain Formation.

Distribution.—The Fort Payne follows a line of outcrop along the dip slopes of all the ridges of the Red Mountain Formation in Floyd County, and is exposed at innumerable places throughout this distance. Probably the best single exposure of the formation is in the cut of U. S. Highway 27 at Crystal Springs. Highly weathered Fort Payne can be seen in the cut of the same highway 1 mile south of Armuchee. The basal Fort Payne is in contact with the Chattanooga Shale where Georgia Highway 20 cuts across the south end of Turnip Mountain.

In Polk County the Fort Payne occupies a broad area east of Aragon, caps a few ridges near Rockmart, and crops out along several narrow faulted ridges south and southwest of Cedartown. One of the best exposures of the formation is in the road metal pits beside Georgia Highway 100, half a mile south of the intersection with U. S. Highway 27.

Fauna and correlation.—In a few localities, the Fort Payne is moderately fossiliferous. Crinoid stem plates as much as an inch in diameter occur along with horn corals, brachiopods, pelecypods, and bryozoa. More typically, though, the formation contains few fossils. If any are present, they are apt to be crinoid stem plate . Even so, these can be diagnostic and are especially helpful in distinguishing the Fort Payne from the Armuchee Chert where exposures are poor and other criteria are wanting. According to Butts (1926, pp. 166, 167) and Butts and Gildersleeve (1948, p. 45), crinoid stems half an inch or more in diameter are common to the Fort Payne of Alabama and Kentucky, and are an infallible criterion for distinguishing the Fort Payne from older formations.

In Polk County, fossils have been found in several places. One locality having abundant specimens is the road metal pits on either side of Georgia Highway 100, half a mile south of the intersection with U. S. Highway 27. Fossils of Mississippian age were first reported from these pits by Butts and Gildersleeve (1948, p. 53), who found *Platycrinus* and a fragment of *Spirifer* (see plate 2, fig. 9). Butts did not recognize the chert as Fort Payne, however, but thought it was part of the Rockmart Slate and thereupon mistakenly dated the Rockmart as Mississippian (fig. 10).

Nearly all of the rock in the road metal pits is fossiliferous, but that in the pit east of the road is less weathered and the fossils there are better, though generally not well preserved. Fossils collected from the pit east of the road and identified by J. T. Dutro, Jr. (U.S.G.S. Colln. No. 21730-PC) include: abundant echinodermal debris, indeterminate; both large and small hor corals, generically indeterminate; tabulate corals, possibly *Cladochonus*; a large indeterminate spiriferoid that may be the same as *Brachythyris* of the next collection; *Composita?* sp.; and *Torynifer* cf. *T. pseudolineata* (Hall) (see plate 2).

Chert and siliceous material in the pit on the west side of Georgia Highway 100, 0.7 mile south of the intersection with U. S. Highway 27 and about 0.2 mile south of the above pit (U.S.G.S. Colln. No. 21731-PC), according to J. T. Dutro, Jr., included indeterminate echinodermal debris; a generically indeterminate small horn coral; *Leptogonia* cf. *L. analoga* (Philips); *Brachythris* cf. *B. suborbicularis* (Hall); *Spirifer* sp., two species indeterminate; *Tornyifer* cf. *T. pseudolineata* (Hall); and *Cleiothyridina?* sp.

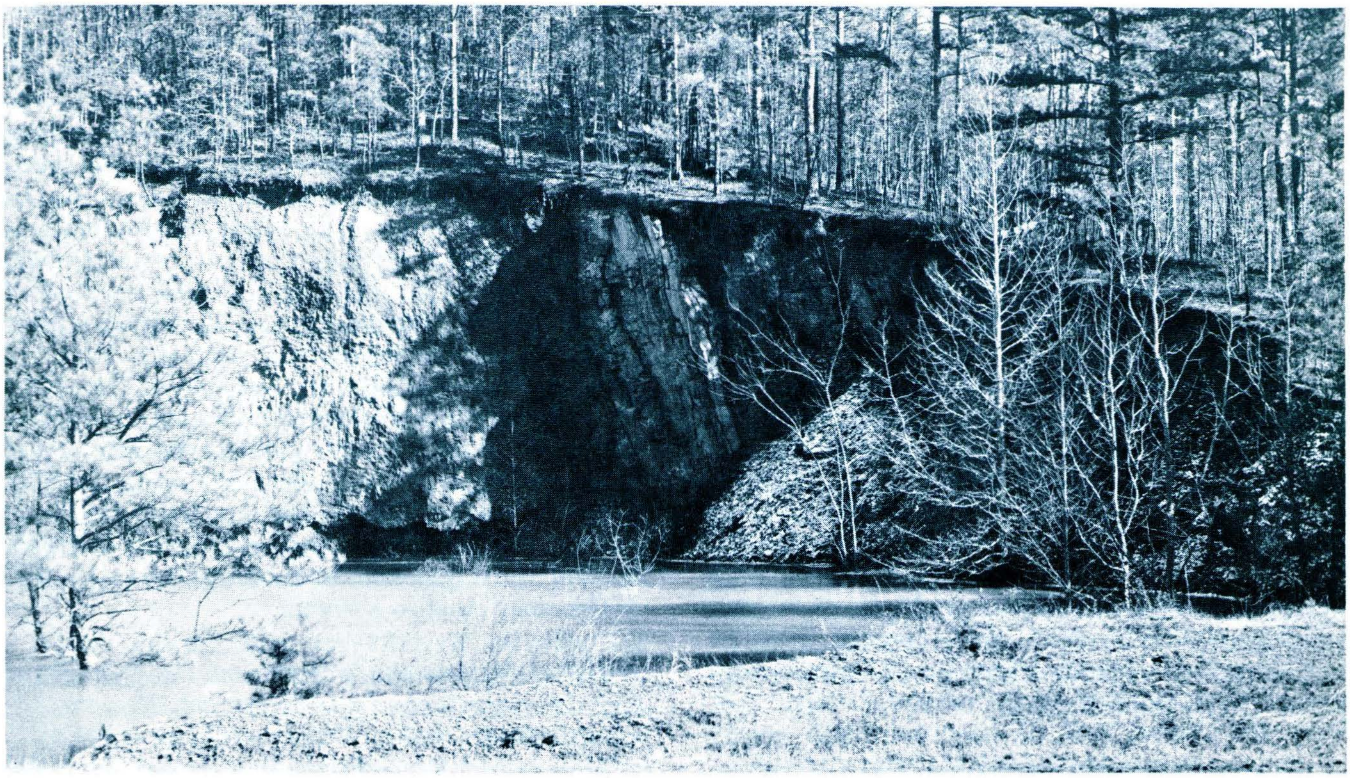

Figure 10. Steeply inclined Fort Payne Chert at top of Rockmart Slate.

The cut of the same highway 0.1 mile farther south (U.S.G.S. Colln. No. 21733-PC) yielded echinodermal debris, indeterminate; and a trilobite pygidium, indeterminate.

Numerous fossils were found in dark gray siliceous shale (Lavender Shale Member) and highly impure chert and siltstone near the northeast end of the lower dam of Elders Lake (U.S.G.S. Colln. No. 21735-PC). The collection included echinodermal debris, a rhynchonelloid brachiopod, pectinacean pelecypods, muculacean pelecypods, other pelecypods, low-spired gastropods, and pleurotomariacean gastropods, all indeterminate. According to John Pojeta, the pectinaceans indicate a Devonian or later Paleozoic age, but none of these specimens are characteristic Devonian types.

A collection from the north shore of the same lake, between 300 and 600 feet southwest of the dam, and at the same stratigraphic position (U.S.G.S. Colln. Nos. 21736-PC and 21737-PC) included echinodermal debris, *Brachythris* sp., probably like that at U.S.G.S. 21731-PC, *Cypricardella* (or *Cypricardinia*), *Sinuitina?* sp., and an indeterminate pleurotomariacean.

John Pojeta states that *Cypricardella* is known from Devonian and Mississippian age rocks and that the range of *Cypricardinia* is Silurian to Mississippian. Thus, these fossils are of little aid in correlating this chert with that on Georgia Highway 100. But, of the gastropods, Ellis L. Yochelson states, "*Sinuitina* is reported to range from Silurian to Permian, although it is known from only one locality each in the Pennsylvanian and Permian. Specimens occur in some abundance in the Coral Ridge Member of Conkin (1957) of the New Providence Formation in Kentucky. They were described by Conkin along with a form which he called *Bembexia ellenae*. That species is fairly elaborately ornamented and, in so far as this crushed pleurotomariacean material can be compared, they are similar." The New Providence Formation is of Osage age, thereby suggesting that the chert at Elders Lake is correlative with the Fort Payne, or at any rate the Lavender Shale Member, which much of the rock more closely resembles.

According to J. T. Dutro, Jr., the collections consisting of a brachiopod-coral-echinoderm assemblage are Mississippian in age, probably an Osage equivalent. Other collections contain distinctive brachiopods that likewise suggest an Osage equivalent. On this evidence, the formation is identified as Fort Payne Chert.

The Fort Payne at several other localities in Polk County yields poorly preserved fossils of the same general types. A variety of specimens was seen in the road metal pit just east of the paved road on the ridge, half a mile south of Pine Bowers Church (U.S.G.S. Colln. No. 21732-PC) including *Torynifer?* sp. (see plate 2, fig. 13). Molds of crinoid stem plates abound in chert on the ridge south of Old Brewster School. Poorly preserved fossils of various types also are common in the Fort Payne and Lavender Shale Member about 2 miles southwest of the center of Rockmart. So far as is known, the latter locality is the southeasternmost occurrence of the fossils in the formation; east of there all faunal evidence seems to be absent, possibly having been obliterated by the combined effects of recrystallization, cleavage, and brecciation which everywhere affects the formation.

Hydrology.—The water-bearing character of the Fort Payne Chert and the Armuchee Chert are discussed together. This was done because the two formations are alike lithologically, and because wells beginning in the Fort Payne commonly pass through it into the Armuchee and derive water from both formations. Moreover, in west-central Floyd County, where the lower part of the Fort Payne is thickly developed, it is separated from the Armuchee only by the thin Chattanooga Shale, and for practical purposes the two chert formations constitute one hydrologic unit.

Although they presently are little used as aquifers, the Fort Payne and the Armuchee are important because they have large potential. They seem capable of supplying moderate to large yields to wells over much of their outcrop area. At the same time, however, due to the high permeability of the chert, both the Fort Payne and the Armuchee are easily contaminated and, consequently, they present special problems of well location and construction

Comparatively little hydrologic data could be obtained for the formations as they uphold ridge areas where few people reside. From what was learned it seems that everywhere except on steep slopes and on narrow ridge crests, the formations can be expected to yield between 5 and 50 gpm to wells less than 150 feet deep. On fairly broad ridges such as the Beach Creek Anticline, supplies adequate for domestic needs probably can be obtained. Well 3JJ36, for example, which is 149 feet deep, was test pumped at the rate of 10 gpm; at the end of 3 hours and after it had drawn down only 7 feet, the water level stabilized at a depth of 77 feet below land surface. Even though this test was very limited, it gives a specific yield for the well of about 1.4 gallons per minute per foot of drawdown and indicates that it can supply considerably more than 10 gpm.

In the few places where the formations underlie valleys near a stream, such as at Crystal Springs and at Armuchee, yields of 50 to 100 gpm or more probably are possible. However, as water can travel far through the chert without being purified, caution must be exercised not to locate a well dangerously close to a stream.

The quality of the water from the Fort Payne and the Armuchee generally is good. The water is reported to be soft and it commonly is referred to as "freestone." The only problems of water quality probably originate in the Chattanooga Shale; wells penetrating the Chattanooga may be contaminated to a greater or lesser degree by sulfides and iron the amount of contamination depending on the thickness and the permeability of the shale at that place. This problem can be avoided by properly casing off the Chattanooga but, mainly for economic reasons, it is rarely done.

In Floyd County where the Armuchee and the Fort Payne make up hogbacks that parallel the high ridges of the Red Mountain Formation, the chert beds commonly are inclined from 20 to 45 degrees. Wells drilled near the base of a hogback may stand a good chance of tapping water under artesian pressure sufficient to result in a flowing well. Artesian conditions are most likely in the Armuchee as it is confined beneath the impervious Chattanooga Shale, but in the parts of Floyd County where the Fort Payne is succeeded by an appreciable thickness of the Lavender Shale Member, artesian conditions in it also may exist.

Several small springs discharge from the base of the ridges upheld by the formations, but the flows of all but a few are so small they are used only for stock watering and domestic supply. Spring 5KKS1, on the other hand, discharges about 0.2 mgd and furnishes water for the Girl Scouts of America camp.

The chert beds in the Armuchee and the Fort Payne are very even and continue uninterrupted for hundreds of feet, making it possible for ground water to move great distances along the bedding plane openings and through joints without undergoing filtration to remove impurities. For this reason, wells and springs in the formation are especially susceptible to pollution and contamination.

The danger of pollution was forcefully brought to public attention in the summer of 1963 by an epidemic that spread through the Girl Scouts of America camp in northern Floyd County. As health officials quickly determined, the infection was transmitted by the water supply which was being pumped, unchlorinated, from spring 5KKS1. The spring is topographically below and down dip from the main buildings of the camp.

Tests revealed that the bacteria reaching the spring originated in flush toilets that recently had been installed at the camp. Fluorescein (a dye) flushed down the toilets, to the consternation of everyone involved, appeared in the spring water in less than 48 hours. To reach the spring, the dye had to pass through the septic tank, seep from the field lines into the aquifer, and travel several hundred feet along the bedding planes. The short travel time resulted because the septic tank had been placed up hill from and almost directly on strike with the spring. Polluted water passed virtually unfiltered from the deeply buried field lines into the bedding plane openings of the chert and traveled rapidly down gradient to the spring.

Correcting this condition involved considerable expense; it was necessary to move the septic tank and the field lines down hill from the main camp far enough to insure that the effluent was topographically well below the spring.

This unfortunate event brings into focus the extreme importance of carefully locating well sites and of positioning any source of pollution or contamination, whether human or animal, sufficiently far from and adequately down gradient from a well or spring. In every instance, it is imperative that the gradient for both surface water and ground water be taken into account and that due consideration be given the dip and strike of the formations involved. With chert aquifers especially, as water readily moves along and at right angles to the bedding, it is necessary to consider equally the topographic setting and the geologic structure in choosing a well site or disposing of waste.

Lavender Shale Member

The Lavender Shale Member of the Fort Payne Chert of Osage age was named by Butts and Gildersleeve (1948, p. 44) for exposures along the Central of Georgia Railway a third of a mile west of Lavender Station, Floyd County, Ga.

Hurst (1953, p. 218) showed that on very fresh exposures, much of the Lavender contains more than 50 percent lime; consequently, he suggested dropping the word "shale" from the name. However, in most natural exposures and in all but the deepest manmade ones, weathering has reduced the rock to calcareous mudrock or shale. Thus, the original name "Lavender Shale Member" is being retained because it is more descriptive of the formation as it normally appears at the surface. The name Lavender Shale Member of the Fort Payne Chert as used in this report has been adopted by the U. S. Geological Survey.

Lithology.—At its type locality in Floyd County the Lavender Shale Member consists of massively bedded greenish mudstone and olive-gray shale containing abundant crinoid stem plates half an inch or more in diameter and several other types of fossils, notably bryozoa The formation also contains large geodes that are lined with crystals of calcite or quartz, or both.

The rock at the type locality is moderately to highly weathered and thus it is fairly typical of the formation as it generally appears at the surface. Relatively fresh Lavender, on the other hand, such as occurs in well cuttings, deep excavations, and some quarries, has a significantly different appearance.

Comparatively fresh Lavender Shale is exposed in the quarry on the east side of U. S. Highway 27, at the overpass of the Southern Railway in the northern part of Rome. It is mainly interbedded dark gray to nearly black, highly impure limestone, and calcareous claystone and siltstone. A few layers of noncalcareous siltstone also occur. Discontinuous chert layers and nodules rarely more than 2.5 inches thick are scattered throughout the section. The chert is dark gray and commonly is crisscrossed by fractures filled with calcium carbonate. Geodes as much as 6 inches in diameter, lined with quartz and calcite crystals, are fairly common.

Weathering of the Lavender takes place rapidly and blocks that were quarried 30 years ago have changed from dark gray to light, medium, or bluish gray, and ones longer exposed have become tan or tan with an orange cast. As the rock decomposes, it breaks down into small irregularly shaped pieces that have rough bedding surfaces; the more silty pieces are similar in appearance to the pieces of siltstone that collect in the residuum of the Floyd Shale. The chert in the Lavender changes from dark gray to tan and, with the solution of calcium carbonate from the fractures, it splits into small straight-sided pieces.

The geodes that occur in the Lavender are unique to it and to the Fort Payne Chert in Floyd County. Because of this, they are an important aid in identifying the weathered Lavender. The geodes range from about half an inch to more than 6 inches across, and all but the smallest, which are solid, are lined with dirty-white crystals of quartz or calcite, or both. Although these geodes are not present in all outcrops of the Lavender, they do occur in most and can play an important role in separating the Lavender from the Floyd Shale with which it may be in contact. Geodes were not found to occur in the formation in Polk County.

Massively bedded limestone cropping out in the Oostanaula River beneath the bridge at the north end of Turkey Mountain seems to be part of the Lavender as it is below the Fort Payne Chert that marks the top of the Lavender in the pit near the bridge. Its relative position indicates that the limestone lies above the highest shale of the Lavender exposed in the road cut, but its thickness could not be determined due to limited exposure.

South and southwest of Cedartown in Polk County, the Lavender Shale Member is mainly medium to light-gray or tan silty and cherty shale that intertongues with and is interbedded with the Fort Payne Chert. East of the Cedartown area, the Lavender generally is less silty and it remains a fairly thick unit nearly as far east as Rockmart, but does not seem to be present east of there.

Distribution.—Good exposures of the Lavender Shale Member in Floyd County can be seen along the road that crosses the south end of Turkey Mountain for a distance of about a mile west of the Oostanaula River. Unusually fossiliferous Lavender was uncovered in the cut of Davis Road at the north end of Turkey Mountain. The formation is present at several places near Crystal Springs and beside U. S. Highway 27 south of Armuchee Creek. The freshest exposures of the Lavender in the study area are in the quarry and nearby railroad cuts on the east side of U. S. Highway 27 at the overpass of the Southern Railway in the northern part of Rome. Other good outcrops occur in the Oostanaula River just north of the Southern Railway bridge and near the intersection of Shorter Avenue and Horseleg Mountain Road in West Rome. Extensive outcrops are present west and southwest of the General Electric Plant where the Lavender makes up a slight elevation along the south edge of the Garden Lakes Subdivision. The formation is exposed beside Georgia Highway 20 just west of the crossing over the Southern Railway about 5 miles west of Rome.

The Lavender is present in most outcrops of the Fort Payne in Polk County west of Rockmart It is well exposed in the road metal pit east of Georgia Highway 100, half a mile south of the junction with U. S. Highway 27, and it crops out at the south end of the cut made for the lower dam of Elders Lake. A good outcrop of the shale occurs along and in the valley west of the unpaved road, just south of the intersection 1.8 miles southwest of the center of Rockmart.

Fauna and correlation.—The weathered Lavender Shale Member in Floyd County locally, although not commonly, yields crinoid stem plates 0.5 to 1.0 inch in diameter, along with solitary corals and a few trilobites.

The Lavender in western and central Polk County is moderately fossiliferous and large numbers of specimens were collected there. The fossils were used to establish the presence of the Fort Payne Chert in the county and therefore are listed and discussed in the section dealing with the Fort Payne. They show that the Lavender is an Osage equivalent.

Stratigraphic relation.—The Lavender Shale Member represents the eastern and southeastern clastic facies of the Fort Payne Chert. West of a line formed by Taylor Ridge and Whiteoak Mountain in Chattooga, Walker, and Catoosa Counties, Ga., the Lavender Shale Member amounts to little more than a few thin shale layers between beds of chert or to a shale section 5 to 20 feet thick randomly positioned within the Fort Payne. East of there, however, the Lavender becomes a prominent member, replacing from 50 to 125 feet or more of the Fort Payne over wide areas. Moreover, in central Floyd County, where the Lavender reaches a maximum development, it replaces the entire section of Fort Payne except for 10 to 20 feet of chert at the top. The Lavender attains a thickness of about 200 feet near the town of Armuchee and near the south end of Turkey Mountain.

Hydrology.—Ground water in the Lavender Shale Member occurs mainly in joints. The formation has a well developed system of interconnected joints, but they are tight, so the availability of ground water is low.

Although the bulk of the Lavender contains more than 50 percent lime, the large proportion of insoluble material present effectively retards enlargement of joints by solution. Decalcification takes place along the joints, but it rarely penetrates the rock more than about a quarter of an inch. Further solution is prevented by a hard layer of insoluble residue that remains on the joint surface. Thus, the openings remain tight and the formation has small storage capacity. Moreover, the layers of fairly pure clay shale throughout the formation impede the vertical movement of water.

Only limited hydrologic data were available for the Lavender Shale Member, but as far as could be determined, wells in the massive mudstone and very impure limestone average less than 10 gpm. The water generally is soft to moderately hard and much of it contains noticeable quantities of iron. Iron rarely causes a serious problem, however.

Floyd Shale

The Floyd Shale of Mississippian age was named by Hayes (1891, p. 143) for development in Floyd County, Ga. The formation is mainly dark-gray clay and silt shale, but includes a thick unit of limestone at the base and the Hartselle Sandstone Member near the top.

Lithology.—In Floyd County the formation consists mainly of silty micaceous shale that has a dull, rather rough bedding surface. Layers of brown-weathering siltstone and fine-grained sandstone less than 2 inches thick commonly are interlayered with the shale. Clay shale that has a waxy surface is abundant locally, and north of Judy Mountain it is mined for use in making brick.

Much of the shale in the Floyd is highly carbonaceous, and on fresh exposures it is very dark gray to nearly black, resembling the Chattanooga Shale. Weathering bleaches the shale to light gray, then alters it to light brown, chocolate brown, or purplish brown, and finally to pinkish purple. Limonite box works are abundant and remain in the soil after the shale has decomposed.

Small irregularly shaped pieces of purplish-brown sandstone and siltstone weather out of the shale and collect on the surface of the ground, giving it a distinctive purplish cast. Even in the absence of outcrops, the purplish soil that forms on the Floyd is distinctive enough to enable ready identification. Although the shale generally is unfossiliferous, the pieces of sandstone and siltstone in the soil commonly contain impressions of crinoid stems or other fossils.

The Floyd Shale generally is less fissile than the shale of other formations with which it comes in contact. The silty shale tends to split into large slabs about a quarter of an inch thick, whereas the shale of the Conasauga, for example, has a high degree of fissility and yields small flakes only a fraction as thick. Some weathered clay shale of the Floyd has a character similar to that of the Conasauga, but, except where extremely decomposed, normally contains sufficient carbon and mica to be distinguishable. In a few areas, however, as north of Rome, the weathered clay shale of the Floyd is almost identical to the shale of the Conasauga, so that fossils are required to make an accurate separation.

The Floyd Shale includes a basal unit of limestone that crops out at several places in Floyd County and locally is extensively quarried. The unit is composed primarily of thickly to massively bedded medium-gray limestone, much of which is sufficiently pure to be used in making cement. In the Ledbetter quarry in the north part of Rome and on the west side of the Beach Creek Anticline the unit has a thickness of about 300 feet, but in other areas it does not appear to be that thick. Moreover, the exposures of the limestone are so few and so widely scattered, it is possible the unit greatly thins or pinches out between outcrops.

In Polk County, the character of the Floyd Shale differs greatly with the outcrop location. Beside Georgia Highway 100, about half a mile south of the junction with U. S. Highway 27, and a few yards south of the road metal pits, the Floyd is dark-gray greenish weathering slate and shale containing a few beds of fine- to medium-grained, brown-weathering sandstone, half an inch to more than 6 inches thick in which are preserved impressions of minute crinoid stem plates. The shale there is in normal stratigraphic position above the Fort Payne Chert. It apparently was misidentification of this outcrop as Rockmart Slate that led Butts and Gildersleeve (1948, p. 53) to date the Rockmart Slate incorrectly.

The Floyd Shale in this outcrop is in normal stratigraphic position above the Fort Payne Chert, but as can be seen along the south side of the ridge west of the road, it is faulted over by the sandstone, conglomerate, and slate of the Rockmart, which in turn is overthrust by two slices of folded Fort Payne Chert.

East of Van Wert, adjacent to the Cartersville Fault, the Fort Payne Chert is succeeded by dark-gray to nearly black phyllite which tentatively has been identified as Floyd Shale on the basis of apparent superposition and character; the phyllite was derived from carbonaceous shale or slate similar to that forming the Floyd in other areas. Moreover, the phyllite is lithologically dissimilar to the metamorphic material across the Cartersville Fault and has a different attitude.

In the large mine at Oremont, and in another 0.5 mile northeast of there, the Floyd Shale is dark gray, silty, and includes pyritic nodules that commonly contain well-preserved fossils. The shale weathers to tan and purplish brown. A few fine- to medium-grained sandstone layers as much as 6 inches thick occur in places.

Hartselle Sandstone Member

Sandstone at or near the top of the Floyd Shale was mapped by Hayes (1902) as the Oxmoor Sandstone, but that name has been discarded in favor of Hartselle, as restricted by Butts (1926, p. 193). The Hartselle makes up Judy Mountain and the prominent ridge encircling Rocky Mountain in Floyd County. Hayes considered the Hartselle as marking the top of the Floyd Shale, but in Chattooga County, Ga., to the north, a considerable thickness of Floyd Shale succeeds it. For this reason, the Hartselle in Floyd County is considered a member of the Floyd Shale.

On Judy Mountain, the Hartselle Sandstone Member is about 300 feet thick and consists of light to medium gray, thinly to massively bedded, very fine-to medium-grained sandstone and quartzite. Siltstone and quartz-pebble conglomerate also make up an important part of the formation. Siltstone is especially common near the base.

In the vicinity of Rocky Mountain, the Hartselle ranges in thickness from about 50 feet to 200 feet. It is thin bedded, generally 6 inches to 1 foot thick, and is very fine to medium-grained sandstone and siltstone. The fresh rock is very light to light gray, and, like the rock on Judy Mountain, weathers to a rusty brown or maroon.

Distribution.—The Floyd Shale occupies large areas in northern and western Floyd County. It is exposed in numerous cuts along Georgia Highway 20 between Rome and the Alabama State line. A sandy facies of the Floyd crops out beside the spur of the Central of Georgia Railway west of Judy Mountain. Both silt and ~~slay~~ shale are well exposed along the paved road between Garden Lakes Subdivision in West Rome and Lavender Station. The fairly fresh shale in the road cut at Floyd Springs and along the road west of Rocky Mountain is nearly black and resembles the Chattanooga Shale.

The sandstone at the top of the Floyd, the Hartselle Sandstone Member, is displayed in the cut of the paved road that runs south out of Crystal Springs across Little Texas Valley where the road cuts through the low ridge upheld by the formation.

The basal limestone unit of the Floyd is well exposed in the Ledbetter quarry north of Battey State Hospital, in the abandoned quarry beside U. S. Highway 27 at the bridge over Dry Creek, and in the old quarry a short distance north of Russell Field. The limestone also crops out beside the unpaved road, just south of the bridge over Beach Creek, west of Horseleg Mountain, and along King Creek north of Early on the west side of the county. A small outcrop can be seen in the Oostanaula River about 4 miles northeast of the center of Rome, and on the west bank of that river where it passes Turkey Mountain.

In Polk County, the Floyd Shale underlies a large part of the valley near Oremont. Isolated outcrops of Floyd lie above the Fort Payne Chert south and southwest of Cedartown. The very dark gray to nearly black phyllite believed to be Floyd Shale is exposed near U. S. Highway 278 adjacent to the Cartersville Fault east of Van Wert.

Fauna and correlation.—Fossils are fairly abundant in much of the Floyd Shale in Floyd County, and the age of the formation and its general correlation have long been established.

In Polk County, on the other hand, the Floyd Shale was not recognized prior to the work of Crawford (1957) and its age there had not been extablished. Crawford collected several fossils from pyritic nodules exposed in the iron mine 0.5 mile north-northeast of Oremont. Among these, he identified *Lyrogoniatites newsomi georgiensis* Miller and Furnish, a nautiloid cephalopod (Crawford, 1957, p. 48).

Cephalopods collected from the same locality (U.S.G.S. Colln. No. 22703-PC) by the writer (see plate 2, fig. 8) were identified by Mackenzie Gordon, Jr., as *Goniatites* cf. *G. kentuckiensis* Miller and *Neoglyphioceras georgiensis* (Miller and Furnish). These fossils indicate an age equivalent to early Chester for the Floyd Shale at this locality.

Thickness.—The total thickness of the Floyd Shale never has been accurately determined because exposures are intermittent and the shale is highly folded and faulted. Hayes (1902) measured a section between Simms and Lavender Mountains, arriving at a figure of 1,200 feet.

The thickness of the Floyd was not measured directly in Polk County because of poor exposures. Judging from the distance across the outcrop, however, the formation south of Cedartown is about 1000 feet thick, and in the Oremont area it probably is between 200 and 300 feet thick.

Hydrology.—Wells in nearly all areas of the Floyd Shale yield water in sufficient quantities to supply a home or farm. Most wells furnish between 3 and 20 gpm; the largest reported yield was 22 gpm. Eighty inventoried wells in the Floyd had an average depth of 83 feet; the deepest well was 295 feet deep.

The quality of the water in the Floyd varies from good to very poor. About 55 percent of the wells inventoried were reported to have water ranging from soft to very hard, but otherwise of good quality. The remaining 45 percent yield water containing bothersome quantities of iron. In nearly half of these wells the iron concentration is so great that the water rapidly stains porcelain fixtures, and precipitates to form sludge in toilet tanks. Filtration is needed to bring the water to acceptable standards.

Wells having high-iron water show definite patterns of occurrence Iron is common in wells penetrating the lower part of the Floyd; some of limestone unit, and, as they are reported to yield limestone unit and, as they are reported to yield hard water, probably are in the limestone. Others, though, have soft water and seem to be in shale. A group of these high-iron wells occurs near Arrowhead Lake in northern Floyd County; others are clustered around Turkey Mountain and two are northwest of Armuchee.

The occurrence of high-iron water also is common in wells that are close to the axes of the major synclines in the Floyd Shale. This occurrence probably is related to the structure because the wells obtain water from a wide range of stratigraphic positions. A string of these wells is located south of Everett Spring, some are present northwest of Armuchee, and others are east of Judy Mountain.

Wells in or close below the Hartselle Sandstone Member have a high incidence of iron water. The iron probably originates in the sandstone. Wells at this horizon are located along the road going from Armuchee to Little Texas Valley.

No clear relationship seems to exist between well depths and the prevalence of iron in the water. Nor is there any indication, except possibly at the base of the formation, that the presence or absence of lime in the water is related to the iron concentration.

A few springs discharge from the Floyd Shale. Most are small and are used only for stock watering. One spring, 3JJS4, flows about 0.5 mgd. A sample of this water had a total hardness of 85 ppm and an iron content of 0.07 ppm. Spring 4KKS2 flows about 0.3 mgd and is unused.

Bangor Limestone

The Bangor Limestone of Mississippian age, named by Smith (1890, p. 155-157) for Bangor, Blount County, Ala., originally included all rocks of Mississippian age above the Fort Payne Chert. Butts (1926, p. 195) later restricted the Bangor to the limestone above the Hartselle Sandstone Member of the Floyd Shale and below the Pennington Shale. The restricted usage is followed in this report.

Lithology and thickness.—The formation in Floyd County consists of thickly to massively bedded, blue-gray to gray, very pure limestone. Some argillaceous limestone and calcareous shale underlie the Bangor. An undetermined thickness of shale, probably a thinned extension of the Pennington Shale, overlies it. The Bangor is about 300 feet thick.

Distribution.—The Bangor crops out on the slopes of Rocky Mountain about 8 miles northwest of Rome in Floyd County, and underlies the narrow valley between Rocky Mountain and the ridge of the Hartselle Sandstone Member of the Floyd Shale. The Bangor is not known to occur in Polk County.

Hydrology.—Only one well was inventoried in the Bangor Limestone; it is 70 feet deep and reportedly yields 8 gpm of hard water.

Information obtained from the Bangor in other areas of the state shows that the formation, in general, is an excellent aquifer in low-lying areas, but has moderate to low productivity on steep slopes.

On the gentle slopes at the base of Rocky Mountain, and in the comparatively flat lying parts of the adjacent valley, the Bangor can be expected to yield between 3 and 20 gpm. In favorable locations near sources of recharge, the yields may exceed 50 gpm. The water will be hard but generally low in iron content.

Pennsylvania System

The Pennsylvanian System is represented in Floyd County by about 350 feet of sandstone, conglomerate, and shale. Although no attempt was made to correlate them with formations established in other areas, the rocks in Floyd County include lithologies that closely correspond to units on Lookout Mountain, Walker County, Ga., that Johnson (1946) included in the Gizzard and Sewanee Members of the Lookout Sandstone. The Lookout Sandstone of Johnson is equivalent to the Gizzard Formation and Sewanee Member of the Crab Orchard Mountains Formation as designated by Culbertson (1963, p. 51).

Lithology, thickness and distribution.—The rocks of the Pennsylvanian System can be grouped into 3 main units.

The lower unit, which ranges between 50 and 75 feet thick, is predominantly medium- to coarse-grained, thin- and thick-bedded sandstone, but includes an undetermined thickness of dark tan-weathering shale at the base. This unit is followed by a middle unit composed of about 100 feet of thin-bedded fine- to medium-grained sandstone interlayered with a little tan-weathering sandy shale. The upper unit consists of about 100 to 150 feet of coarse-grained thickly to massively bedded sandstone and beds of conglomerate containing well-rounded pebbles of white quartz.

The Pennsylvanian System crops out only on Rocky Mountain in Floyd County.

Hydrology.—At the time of this investigation, the rocks of Pennsylvanian age in Floyd County were not being used as an aquifer, and no hydrologic data for them were available. Information obtained from other parts of the state indicate, however, that in most places, wells less than 300 feet deep can be expected to yield between 2 and 10 gpm and those favorably located may supply as much as 50 gpm. Near the edge of the outcrop, though, which ends in high cliffs, only dry wells are likely, as ground water rapidly drains out of the cliff faces.

Water from the wells will tend to be soft and have a moderate to high iron content. The iron content of some of the water may be so high that filtration will be required to make the water potable.

Cambrian to Pennsylvanian Systems

Talladega Slate

The Talladega Slate was named by Smith (1888) for exposures in Talladega County, Ala. The best available evidence seems to indicate that the Talladega is composed of rocks ranging in age from Precambrian to Carboniferous. Butts (1926, p. 61) believed that the Talladega probably is composed of shoreward clastic deposits that accumulated at intervals during the entire Paleozoic Era.

Lithology and thickness.—In Georgia, the Talladega consists primarily of alternating zones of greenish-gray phyllite and dark gray to nearly black carbonaceous phyllite, much of which includes thin beds of quartzite and graywacke. In a few parts of the formation, quartzite and graywacke become the principal constituents, though phyllite rarely is wanting altogether.

Butts (1926, p. 58) estimated the thickness of the Talladega in Alabama to be about 30,000 feet.

Distribution.—The Talladega underlies all of Polk County south and east of the Cartersville Fault. The Talladega in Polk County is the northern part of a broad belt of the formation that extends from the Cartersville Fault southward across Haralson County.

Correlation.—At the beginning of this study, uncertainties arose as to whether the rocks in Polk County that previously had been mapped as Talladega were, in fact, part of that formation whose type locality is about 50 miles away in Alabama. To arrive at an answer, it was decided to determine if units in Polk County or adjacent Haralson County could indeed be traced into the type Talladega.

One unit selected for tracing was a thick section of graywacke that contains distinctive blue quartz pebbles. The graywacke section extends from southeastern Polk County and northeastern Haralson County, westward across U. S. Highway 27, immediately south of the Tallapoosa River. From there it continues southwestward to the town of Tallapoosa, in Haralson County, cropping out on U. S. Highway 78 at the bridge over the Tallapoosa River. Farther southwest, it forms a string of outcrops in Cleburne County, Ala., including the road cut about 5 miles east of Heflin, that can be followed into the area of the lower part of the type Talladega.

The other unit of the Talladega traced was a layer of fairly pure quartzite that makes up a continuous ridge extending from the northeast corner of Haralson County, close to the Polk line, in a southwesterly direction to U. S. Highway 27, about half a mile north of Buchanan in Haralson County. It continues beyond there, changing to a southerly direction, and finally disappears beneath the Hillabee Chlorite Schist about 3 miles southeast of the center of Tallapoosa in Haralson County. A short way to the west, a unit that seems to be the same quartzite reappears from beneath the Hillabee and makes up Tally Mountain. From the mountain, the quartzite can be traced westward to a cut on Georgia Highway 100, about 2 miles south of Tallapoosa, and then southwestward into Alabama. The quartzite unit crops out along the unpaved roads in the vicinity of Lebanon, Ala., beside the paved road between Abernathy and Plainville, and at several places along the ridges (some of which have fire lookout towers) between Plainville and the prominent ridge north of Abel, in southwest Cleburne County. The quartzite north of Abel is continuous with the Cheaha Sandstone Member of the Talladega Slate on Cheaha Mountain, which extends into the middle of the type Talladega, in Talladega County.

The Hillabee Chlorite Schist, which forms the southern boundary of the Talladega in Alabama, also was traced into Georgia. Except for a few short breaks, the Hillabee has a continuous outcrop along the south edge of the Talladega all the way from Talladega County, north-central Alabama, into northwestern Georgia. The Hillabee enters Georgia near the southwest corner of Haralson County and is well displayed where it crosses Georgia Highway 100 in the valley of Walker Creek.

Hydrology.—The hydrologic properties of the Talladega vary greatly within short distances. Wells in phyllite normally yield from less than 1 gpm to about 5 gpm; they average about 150 feet deep. Phyllite containing an appreciable proportion of fracture rock can be expected to yield between 2 and 10 gpm from depths of 50 to 200 feet.

Zones in the Talladega composed primarily of thin-bedded quartzite or graywacke, even though some phyllite is present, yield 10 to 25 gpm, mostly from depths less than 150 feet. Higher yields may be possible where thickly to massively bedded quartzite or graywacke occupy a topographic position favorable to recharge, as along the Tallapoosa River.

Water from the formation is reported to be soft, except for one well, which was said to have moderately hard water. Iron was reported in some wells, but the concentration generally was low to moderate and rarely high.

A few wells drilled close to the escarpment that forms the northern limit of the formation generally have been dry. The topographic break is very pronounced and the escarpment is deeply dissected at short intervals, resulting in a low availability of water.

Because of the prevalent interlayering of permeable and impermeable strata in the Talladega, the principal direction of ground-water movement is along the bedding. For this reason, the strike of the bedding greatly influences well productivity. Wells on strike with a source of recharge, such as a stream, tend to have higher yields because water can pass readily to the well. Conversely, a well drilled across the strike, even though close to a stream, may have a low yield due to the intervening impermeable strata.

GEOLOGIC STRUCTURE

The structure of the geologic formations in Floyd and Polk Counties is chiefly the typical Valley and Ridge type. The rocks are folded into a series of subparallel anticlines and synclines, locally broken by faults. Most of the major topographic features in Floyd County, notably Lavender, Turkey , and Horseleg Mountains, are anticlinal. Rocky Mountain, by contrast, is synclinal having a structure similar to Lookout and Pigeon Mountains in Walker County, Georgia, considered part of the Cumberland Plateau. Indian Mountain in Polk County is a large synclinorium.

Two major thrust faults crossing Floyd County, the Rome Fault and the Coosa Fault, have greatly affected the outcrop patterns of the formations. The Rome Fault, named by Hayes (1891), passes from the northern part of the county in a zigzag line to Rome, turning westward from there and following an irregular trace into Alabama. The fault is a very low angle thrust that displaced the Conasauga Formation (Cambrian) northwestward several miles over younger formations. The thrusting occurred some time after the deposition of the Floyd Shale (Mississippian).

The Rome Fault can be observed at several places on the west side of the Garden Lakes Subdivision in Rome. Where shale is thrust over shale, the fault zone is very thin, and shows up as a 1- or 2-inch layer of white gouge. Where harder rocks, either siltstone or limestone, are in contact, the fault zone generally is 5 to 10 feet thick and contains a mixture of rocks from above and below. All exposures of the fault zones indicate that it is tight, and offers no avenue for ground-water movement. This was substantiated by data obtained from the well inventory.

Hayes (1891, p. 145) cites abundant evidence that the Rome Fault is a very flat thrust. In view of this, the occurrence of a remnant of the Rome thrust sheet on the northwest side of the major anticline forming Horseleg Mountain indicates that thrusting along the fault preceded the full development of the major folds. The flatness of the thrust plane also means that the Rome Fault did not cause the abrupt termination of the southward-trending structures forming Horseleg Mountain, the Beach Creek Anticline and Turnip Mountain. These structures were cut off by one or more east-west trending high-angle faults that later were overridden by the Rome thrust sheet. Such east-west faulting was used by Hayes (1891, p. 147) to explain the termination at their south ends of Kincaid Mountain in western Floyd County, and Gaylor Ridge and Dirtseller Mountain in adjacent Alabama; they are cut off close to the trace of the Rome Fault.

The other major fault crossing Floyd County is the Coosa Fault, which was given that name by Hayes (1894) because it lies along the south edge of the Coosa Valley. The fault angles northeasterly across the county, bringing the Rome Formation, and in a few places, the Shady Dolomite, up into contact with the Conasauga.

At the only place the plane of the Coosa Fault was observed—beside Spout Springs Road, just southeast of the point where the road crosses Big

Cedar Creek—the fault forms a zone several feet thick, made up of a mixture of rocks from above and below. Folding is intense beneath the fault zone, but very slight above it. The fault zone appears to be very tight, and it probably acts as a barrier to the movement of ground water.

Several comparatively short, high-angle faults branch off the Coosa Fault near Cave Spring and bring slices of the Rome Formation upward into contact with the Conasauga and displace the Conasauga up against the Knox Group. Similar faults parallel the Coosa Fault north and south of Rome and cause displacement in the same formations.

The other major fault in the study area, the Cartersville Fault, cuts across the east and south parts of Polk County, moving the metamorphic Talladega Slate into contact with formations of Ordovician age or younger. The fault terminates the southerly structural trends in the formations north of it; rocks on opposite sides of the fault have divergent strikes and, for the most part, are of different lithologies. The trace of the Cartersville Fault is marked by a prominent fault scarp commonly over 100 feet high.

Another east-west fault 7 miles long passes a short way south of Youngs, Polk County, crossing U. S. Highway 27 about 4 miles south of Cedartown. The fault has a displacement of about 500 feet, bringing the Knox Group (Cambrian) up into contact with the Rockmart Slate (Ordovician); it cuts off a large syncline in the Rockmart and Newala near Antioch School and the belt of Newala that extends southward out of Cedartown.

Indian Mountain

The interpretation of the structure and stratigraphy of Indian Mountain has evolved in a rather interesting manner. Earliest workers (Smith, 1890; Hayes, 1892) showed Indian Mountain and the adjacent valley on the southeast to be underlain by Weisner Quartzite of Early Cambrian age. In 1894, Hayes showed the mountain as Weisner Quartzite, but mapped the valley to the southeast as Conasauga. After further work in the area, Hayes (1902) revised his map and showed the valley southeast of the mountain as Beaver Limestone (Shady Dolomite of present usage). This interpretation has persisted until the present (Butts, 1948), except for Crawford (1957), who mapped the valley as Weisner.

As is discussed in the section on the Frog Mountain Sandstone, lithologic and stratigraphic evidence indicates that Indian Mountain is composed not of Weisner Quartzite, but of Frog Mountain Sandstone and probably younger rocks. The distinctive "birdshot conglomerate" is continuous to the base of Indian Mountain where it overlies the Rockmart Slate and underlies the basal quartzite and conglomerate beds that make up Indian Mountain. As Indian Mountain is a synclinorium, contrary to Hayes' (1902) depiction, the strata on the mountain are stratigraphically above rather than below the rock in the valley to the southeast (now known to be Rockmart Slate and Newala Limestone) and, therefore, are of Devonian age or younger.

Mapping in Cherokee County, Ala., by Cloud (1967) shows that the northwest side of Indian Mountain follows the same stratigraphic sequence as the southeast side: Knox Group, Newala Limestone, and Rockmart Slate. Although past workers, including Cloud, have shown the northwest side of Indian Mountain to be made up of Weisner Quartzite thrust over formations of Ordovician age, further study probably will show that there is no fault and that the sequence is normal from the formations of Ordovician age up through the Frog Mountain Sandstone of Devonian age, and perhaps younger rocks.

The age of the rocks comprising the upper reaches of Indian Mountain has not been determined, and to do so may require considerable field time because of the extreme scarcity of fossils. This much has been learned, however: the beds on the north side of the mountain dip southeasterly, apparently forming the northwest limb of a synclinorium. As can be seen along the road crossing, the mountain from near Bluffton, Ala., to near Hematite Crossing, Ga., the north base of the mountain is formed by light weathering shale, followed by 100 to 200 feet of sandstone and quartzite that resembles the Frog Mountain Sandstone at Oremont. Above this are 1,000 to 2,000 feet of shale mixed with thin layers of brown-weathering siltstone and fine-grained sandstone. At the top of the section is a considerable thickness of light gray, massively bedded quartzite, sandstone, and conglomerate. The lithology and sequence of these units suggest that the lower shale, sandstone, and quartzite is Frog Mountain, the succeeding thick shale section is Floyd Shale, and the upper quartzite is the Hartselle Sandstone Member of the Floyd Shale or other sandstone of Mississippian age, or younger. Sandstone of Mississippian age was mapped by Cloud (1967) a short way west in Alabama.

Etna Valley

The valley southeast of Indian Mountain, extending from the Alabama State line through Etna, Prior, and Oremont to Hematite Crossing, hereafter referred to as Etna Valley, long was one of the principal iron producing centers of Polk County. Iron was mined there as recently as 1955.

Over the years, the structure and stratigraphy of Etna Valley have been given several interpretations. Hayes (1891, 1892) mapped the valley as Weisner Quartzite, but in 1894 showed it as Conasauga, bounded on the north end by Weisner Quartzite. Another chenge came in 1902 when Hayes showed the valley as Beaver Limestone (of former usage), but mapped a narrow strip of Weisner Quartzite along the southeast side. Several workers following Hayes similarly mapped Etna Valley as Shady Dolomite until Crawford (1957) showed it once again as Weisner Quartzite.

During his investigation of the area, Crawford (1957) discovered lithologic and paleontologic evidence that the Newala Limestone and the Floyd Shale were present in the eastern part of Etna Valley. These discoveries, though, were made at the end of his study and Crawford had insufficient time to determine the significance of his finds.

Following Crawford's lead, the writer made additional fossil finds and obtained other data establishing that Etna Valley is entirely underlain by formations ranging in age from Early Ordovician to Mississippian.

Th The part of Etna Valley around Oremont is a doubly plunging asymmetric syncline cradled in the Knox Group and underlain by the Newala Limestone, some Rockmart Slate, a thin section of Armuchee Chert, the Frog Mountain Sandstone, in one place some Fort Payne Chert, and covered in the center by the Floyd Shale.

UTILIZATION OF GROUND WATER

Ground water, mostly from wells, is used by several thousand rural residents in Floyd and Polk Counties and is the only water available to most of them. Public utilities distribute water in and around the cities and towns and along most of the main roads, but large areas of the counties are totally dependent on ground water. Dairies, chicken houses, egg processing plants, farms, and churches commonly depend on wells.

Industrial demand for ground water has increased manyfold in the past few decades, but where well water is the only source of supply, the demand has largely gone unmet. At Plant Hammond, the Georgia Power Company had to drill three deep wells to get one that would supply 100 gpm. Georgia Kraft Company had several wells drilled in an attempt to develop a supply, but none of the wells was successful. The General Electric Company in Rome investigated the prospects of obtaining 300 gpm from one or more wells, but abandoned the project after deciding that the amount of recharge in the area was insufficient to meet continued withdrawals. Only in the Cedartown area, which is underlain by the Newala Limestone, have wells been able to meet the heavy demands of industry. Wells there are being used to supply 600 to 1,500 gpm.

Spring water, on the other hand, is available in large quantities from springs discharging from the Newala Limestone and the Knox Group, but very little is being used. Aragon Mills is the only industry utilizing spring water and they take several hundred thousand gallons per day from spring 5GGS1 in Polk County.

A somewhat larger volume of spring water is being processed for municipal supplies: Cedartown takes 1.5 mgd from Cedartown Spring, and the town of Cave Spring and the Georgia School for the Deaf are supplied by water from Cave Spring.

WATER-LEVEL FLUCTUATIONS

Periodic measurements were made on several wells in the study area to ascertain the amount of seasonal fluctuation occurring in the ground-water level. The results show that in flat lying areas that have undergone only minor dissection by streams, the annual fluctuation is in the range of 5 to 10 feet. In more hilly areas where the relief amounts to several tens of feet, the variations range between 10 to 25 feet.

The water levels generally are highest during the months of April and May, and recede slowly to their lowest points in November, December, and January.

Long term variations in ground-water levels resulting from cyclic differences in precipitation over a period of years probably produce changes in the ground-water level, but their extent is not known. The well inventory did not indicate that water levels have dropped significantly; water levels had remained nearly the same for the past 20 to 50 years.

SUMMARY OF GROUND WATER

In all areas of Floyd and Polk Counties, except on steep slopes and narrow ridges, ground water is available in quantities sufficient to supply a modern home or farm. The chemical quality of the water generally is satisfactory, although in a few localities such impurities as iron may necessitate a filtration system. Wells normally are less than 200 feet deep.

Large capacity wells have been developed in the Newala Limestone in Polk County, and this aquifer offers the best source of industrial well supply. Wells can be developed that will supply 600 to 1,500 gpm.

Springs in Floyd and Polk Counties discharge more than 35 mgd, of which approximately 95 percent is unused except to maintain streamflow. The chemical quality of the spring water is suitable for domestic and many industrial needs. Water samples from six of the largest springs had an average total hardness of 112 ppm and an iron content of 0.05 ppm.

REFERENCES

Berry, William B. N., 1960, Graptolite faunas of the Marathon region, West Texas: Texas Univ. Pub. 6005, 179 p.

Butts, Charles, 1926, Geology of Alabama: The Paleozoic rocks: Alabama Geol. Survey Spec. Rept. 14, p. 41-230.

______ and Gildersleeve, Benjamin, 1948. Geology and mineral resources of the Paleozoic area in northwest Georgia: Georgia Geol. Survey Bull. 54, p.3-79.

Cloud, Preston, Jr., 1967, Geology and bauxite deposits of the Rock Run and Goshen Valley areas, northeast Alabama: U. S. Geol. Survey Bull. 1199-N, p. 1-74.

Conkin, J. E., 1957, Stratigraphy of the New Providence formation (Mississippian) in Jefferson and Bullitt Counties, Kentucky, and fauna of the Coral Ridge member: Bulls. Am. Paleontology, v. 38, no. 168, p. 109-157.

Cooke, C. W., Crickmay, G. W., Butts, Charles, Hays, C. W., Keith, Arthur, McCallie, S. W., 1939, Geologic map of Georgia: Georgia Geol. Survey map.

Cooper, G. Arthur, 1956, Chazyan and related brachiopods: Smithsonian Misc. Colln., v. 127, 1245 p.

Crawford, T. J., 1957, Geology of part of Indian Mountain, Polk County, Georgia and Cherokee County, Alabama: Georgia Min. Newsletter, v. 10, no. 2, p. 39-51.

Cressler, C. W., 1963, Geology and ground-water resources of Catoosa County, Georgia: Georgia Geol. Survey Inf. Circ. 28, 19 p.

______, 1964, Geology and ground-water resources of the Paleozoic rock area, Chattooga County, Georgia: Georgia Geol. Survey Inf. Circ. 27, 14 p.

______ 1964, Geology and ground-water resources of Walker County, Georgia: Georgia Geol. Survey Inf. Circ. 29, 15 p.

Croft, M. G., 1963, Geology and ground-water resources of Bartow County, Georgia: U. S. Geol. Survey Water-Supply Paper 1619-FF, 32 p.

______, 1964, Geology and ground-water resources of Dade County, Georgia: Georgia Geol. Survey Inf. Circ. 26, 17 p.

Culbertson, W. C. 1962, Pennsylvanian nomenclature in northwest Georgia: U. S. Geol. Survey Prof. Paper 450-E, p. 51-57.

Hayes, C. W., 1891, The overthrust faults of the southern Appalachians: Geol. Soc. America Bull., v. 2, p. 141-154.

______, 1892, Geology of northeastern Alabama, and adjacent portions of Georgia and Tennessee: Alabama Geol. Survey Bull. 4, 85 p.

______, 1894, Geology of a portion of the Coosa Valley in Georgia and Alabama: Geol. Soc. America Bull., v. 5, p. 465-480.

______, 1902, Rome, Georgia: U. S. Geol. Survey Geol. Atlas, Folio 78.

Hurst, V. J., 1953, Chertification in the Fort Payne Formation, Georgia: Georgia Geol. Survey Bull. 60, p. 215-238.

Johnson, Vard H., 1946, Coal deposits on Sand and Lookout Mountains, Dade and Walker Counties, Georgia: U. S. Geol. Survey Prelim. Map.

Keith, Arthur, 1903, U. S. Geol. Survey Geol. Atlas, Cranberry, N. C.-Tenn., Folio 90.

Kellberg, J. M., and Grant, L. F., 1956, Coarse conglomerates of the Middle Ordovician in the south Appalachian Valley: Geol. Soc. America Bull., v. 67, p. 697-716.

LaForge, L., and others, 1925, Physical Geography of Georgia: Georgia Geol. Survey Bull. 42, 189 p.

Laurence, Robert A., 1961, Report of igneous rock near Rome, Georgia is erroneous: Georgia Mineral Newsletter, v. 14, nos. 2 and 3, p. 39-41.

Maynard T. P., 1912, The limestone and cement materials of north Georgia: Georgia Geol. Survey Bull. 27, 293 p.

McCallie, S. W., 1910, A preliminary report on the mineral resources of Georgia: Georgia Geol. Survey Bull. 23, 184 p.

Safford, James M., 1869, Geology of Tennessee: State of Tennessee, Nashville, 550 p.

——— and Killebrew, J.B., 1876, The elementary geology of Tennessee: Nashville, 255 p.

Salisbury, John W., 1961, Geology and mineral resources of the northwest quarter of the Cohutta Mountain Quadrangle: Georgia Geol. Survey Bull. 71, 61 p.

Smith, E. A., 1876, Alabama Geol. Survey Rept. Prog. for 1876, p. 11, 23, 25, 42, 207-208.

———, 1888, Alabama Geol. Survey Rept. Prog. for 1884-88.

———, 1890, Alabama Geol. Survey Report on Cahaba coal field, p. 133-180.

Spencer, J. W., 1893, The Paleozoic group; Geology of ten counties of northwestern Georgia: Georgia Geol. Survey, 406 p.

Ulrich, E. O., 1911, Revision of the Paleozoic systems: Geol. Soc. America Bull., v. 22, p. 281-680.

Veatch, Otto, 1909, Clay deposits of Georgia: Georgia Geol. Survey Bull. 18, 453 p.

Yochelson, Ellis L. and Bridge, Josiah, 1957, The Lower Ordovician gastropod *Ceratopea:* U. S. Geol. Survey Prof. Paper 294-H, p. 281-304.

APPENDIX A
Fossil Illustrations

PLATE 1

Characteristic Cambrian and Ordovician Fossils

Figure 1. *Elrathia georgiensis* Resser, x 1½. Middle Cambrian, Conasauga Formation. USGS locality 4171-CO, outcrop on east bank of Coosa River at the water line at Copras Bluff, 3.5 miles east of Georgia-Alabama state boundary. USNM no. 162542.

Figure 2. *Acmarhachis ulrichi* (Resser), x 4. Upper Cambrian, Conasauga Formation. USGS locality 4415-CO, a ditch on south side of paved road, about 25 yards west of intersection of road crossing tracks going to Garden Lakes School, south of Club House, Garden Lakes subdivision, Rome, Georgia. USNM no. 162543.

Figure 3. *Scaevogyra* cf. *S. swezeyi* Whitfield, x 1. Upper Cambrian, Knox Group. USGS locality 4417-CO, outcrop on southwest end of Horseleg Mountain (Mount Alto), about 6 miles southwest of the center of Rome, Georgia. USNM no. 162544.

Figure 4. *Tricrepicephalus* species, x 2. Upper Cambrian, Conasauga Formation at USGS locality 4415-CO. USNM no. 162545.

Figure 5. *Ceratopea tennesseensis* Oder, x 2. Lower Ordovician, Newala Limestone. USGS locality 6302-CO, a roadcut along U.S. Highway 278, west of Cedartown; 2.4 miles E of Georgia-Alabama state boundary and 2.84 miles N of south edge of Rock Run and vicinity quadrangle. USNM no. 162546.

Figure 6a-c. *Ceratopea torta* Cullison, x 1½. Lower Ordovician, Newala Limestone. USGS locality 6294-CO, waste heap of residuum from an abandoned iron strip mine, at Oremont, 3.3 miles S of the Floyd-Polk County boundary, 0.6 mile WNW of Old Fite School and 0.22 mile E of Southern Railway branch line. USNM no. 162547.

Figure 7. *Mcqueenoceras* species, x 1½. Lower Ordovician, Newala Limestone, at USGS locality 6294-CO. USNM no. 162548.

Figure 8. *Allophoceras* species, x 2. Lower Ordovician, Newala Limestone at USGS locality 6294-CO. USNM no. 162549.

Figure 9. *Ceratopea capuliformis* Oder, x 1½. Lower Ordovician, Newala Limestone at USGS locality 6294-CO. USNM no. 162550.

Figure 10a, b. *Ceratopea corniformis* Oder, x 1. Lower Ordovician, Newala Limestone at USGS locality 6294-CO. USNM no. 162551.

Figure 11. *Ceratopea incurvata* Yochelson and Bridge, x 1½. Lower Ordovician, Newala Limestone at USGS locality 6294-CO. USNM no. 162552.

Figure 12. *Ceratopea keithi* Ulrich, x 2. Lower Ordovician, Newala Limestone at USGS locality 6294-CO. USNM no. 162553.

Figure 13. *Climacograptus* cf. *C. scharenbergi* Lapworth, x 6. Middle Ordovician, Rockmart Slate. USGS locality D1092-CO, 4.9 miles SSW of center of Cedartown, Polk County, Georgia, 0.5 mile south of Pine Bowers Church at intersection of paved and dirt road. USNM no. 162554.

Figure 14. *Glossograptus* species, x 6. Middle Ordovician, Rockmart Slate. USGS locality D1093-CO, 5.5 miles SW of center of Rockmart; 4.2 miles S of U.S. Highway 278. USNM no. 162555.

Figure 15. *Glyptograptus* cf. *G. teretiusculus* (Hisinger) x 6. Middle Ordovician, Rockmart Slate. USGS locality D1093-CO. USNM no. 162556.

Figure 16. *Glyptograptus euglyphus* (Lapworth) x 6. Middle Ordovician, Rockmart Slate at USGS locality D1092-CO. USNM no. 162557.

Figure 17. *Glyptograptus* cf. *G. euglyphus* (Lapworth) x 6. Middle Ordovician, Rockmart Slate at USGS locality D1092-CO. USNM no. 162558.

Figure 18. *Climacograptus* aff. *C. riddellensis* Harris, x 6. Middle Ordovician, Rockmart Slate at USGS locality D1093-CO. USNM no. 162559.

Figures 1, 2, 4, identified by A. R. Palmer; 3, 5, 6, 9-12, identified by E.L. Yochelson; 7, 8, identified by R.H. Flower; 13-18, identified by W.B.N. Berry.

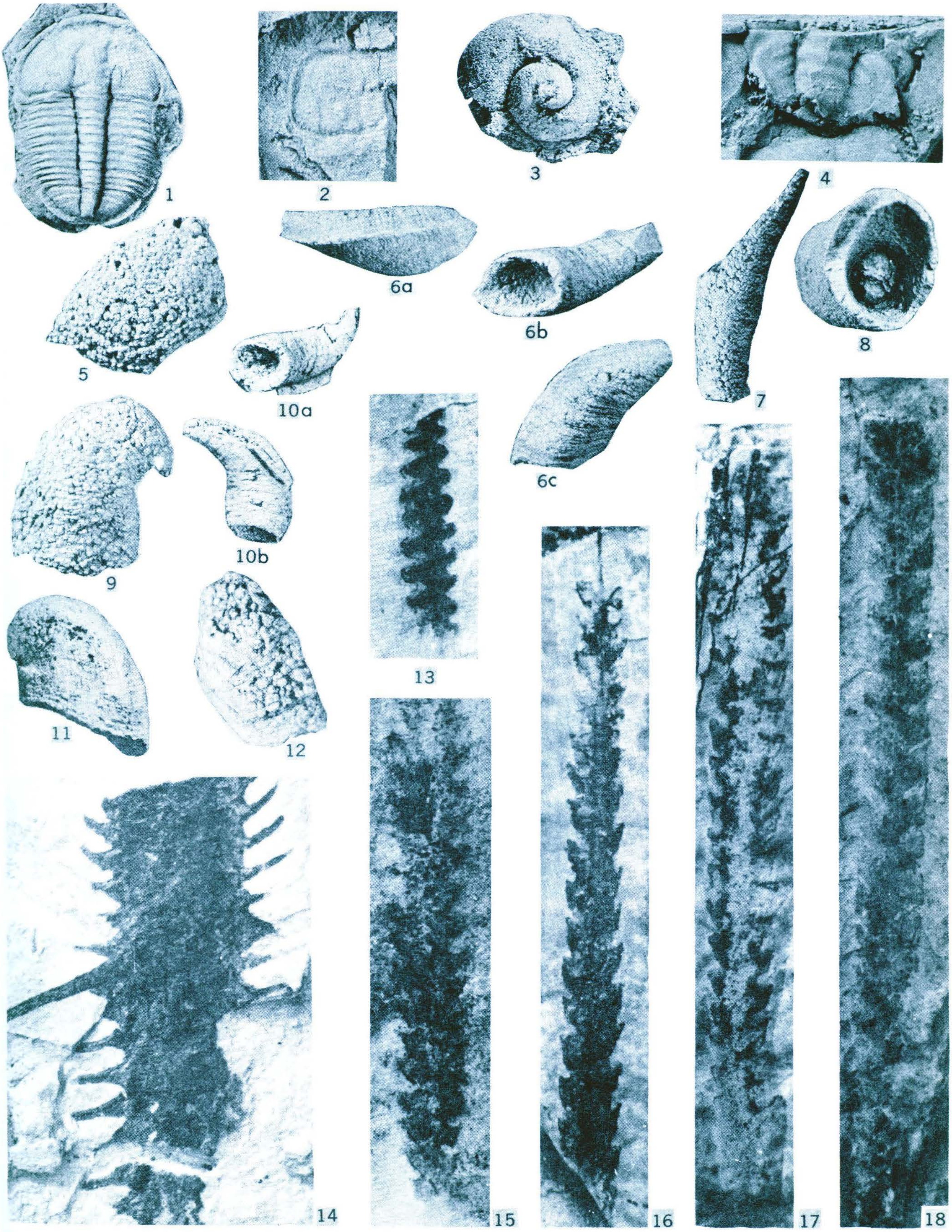

PLATE 1

Characteristic Cambrian and Ordovician Fossils

PLATE 2

Characteristic Ordovician and Mississippian Fossils

Figure 1. Clymenid trilobite x 3. Middle Ordovician. USGS locality D1408-CO, bedded chert in ditch on west side of paved road, 400 feet S of East Armuchee Church, Catlett quadrangle, Georgia. USNM no. 162560.

Figure 2a-c. *Rostricellula variabilis* Cooper, x 2. Middle Ordovician, Ridley Limestone. USGS locality 4425-CO, from southwest end of Horseleg Mountain (Mount Alto) on south side and just below crest of saddle that forms main drainage divide; about 30 feet above Upper Cambrian-Middle Ordovician contact. USNM no. 162561.

Figures 3, 4. *Bathyurus?* cf. *B.? extans* (Hall) x 3. Middle Ordovician at USGS locality D1408-CO. USNM no. 162562, 162563.

Figure 5. *Helicotoma* species, x 1. Middle Ordovician, Mosheim Limestone Member. USGS locality 4128-CO, 2.1 miles NNE of center of Rockmart; 1.1 miles E of Georgia Highway 101. USNM no. 162564.

Figure 6. *Loxoplocus (Lophospira)* species, x 1. Middle Ordovician, Mosheim Limestone Member at USGS locality 4128-CO. USNM no. 162565.

Figure 7. Nuculoid pelecypod, x 1. Lower Mississippian. USGS locality 21735-PC, from road exposures next to pond, at NE end of dam across Elder's Lake; 6.0 miles SW of center of Cedartown and 1.3 miles SE of old Brewster School. USNM no. 162566.

Figure 8. *Goniatites* cf. *G. kentuckiensis* Miller, x 1. Upper Mississippian, Floyd Shale. USGS locality 22703-PC, abandoned iron strip mine about 2100 feet NNE of Oremont railway crossing, Rock Run quadrangle, Georgia. USNM no. 162566.

Figure 9. *Spirifer* species, x 1. Lower Mississippian. USGS locality 21731-PC, from chert pit on west side of Georgia Highway 100, 0.7 miles S of its intersection with U.S. Highway 27. USNM no. 162568.

Figure 10. *Lepiagonia* cf. *L. analoga* (Philips), x 1. Lower Mississippian, at USGS locality 21731-PC. USNM no. 162569.

Figure 11. Pelecypod allied to *Sanguinolites*, x 1. Lower Mississippian at USGS locality 21735-PC. USNM no. 162570.

Figure 12. *Brachythyrus* species, x 1. Lower Mississippian, at USGS locality 21731-PC. USNM no. 162571.

Figure 13. *Torynifer* cf. *T. pseudolineata* (Hall), x 1½. Lower Mississippian. USGS locality 21730-PC. from pit on east side of Georgia Highway 100, 0.4 mile S of its intersection with U.S. Highway 27. USNM no. 162572.

Figure 14. Solitary coral, indeterminate, x 1. Lower Mississippian at USGS locality 21730-PC. USNM no. 162573.

Figure 15. Zaphrentoid horn coral, x 1½. Lower Mississippian at USGS locality 21730-PC. USNM no. 162574.

Figure 16. Auloporid coral, x 2. Lower Mississippian at USGS locality 21730-PC. USNM no. 162575.

Figures 1, 3, 4, identified by R.J. Ross, Jr.; 2, identified by R.B. Neuman; 5, 6, 11, identified by E.L. Yochelson; 7, identified by J. Pojeta, Jr.; 8, identified by Mackenzie Gordon, Jr.; 9-13, identified by J.T. Dutro, Jr.; 12-14, identified by W.J. Sando.

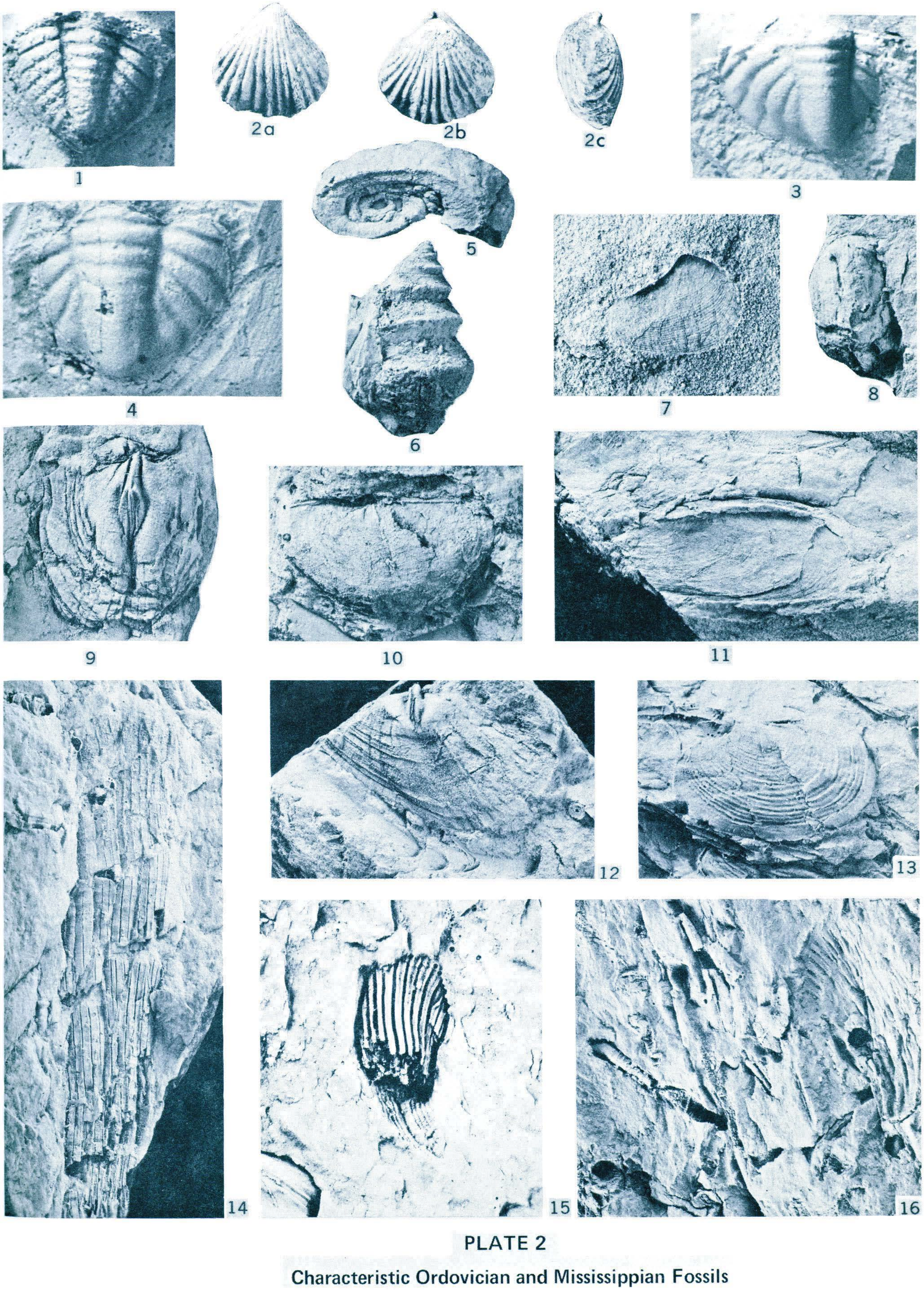

PLATE 2

Characteristic Ordovician and Mississippian Fossils

APPENDIX B
Tables

Table 1.--Geologic formations and their water-bearing properties, Floyd and Polk Counties, Ga.

System	Rock Unit	Thickness (feet)	Lithology	Topography	Hydrologic Properties
Pennsylvanian	Pennsylvanian rocks, undifferentiated	350±	Thinly to massively bedded sandstone and conglomerate; some shale.	Limited to Rocky Mountain, Floyd County	No data available; probably will yield from 2 to 10 gpm in most low areas, perhaps 50 gpm in center of syncline.
Mississippian	Bangor Limestone	300±	Thickly to massively bedded limestone; some shale at the top.	Occurs only on flanks of Rocky Mountain, Floyd County, and small area east of there.	Probably no value as aquifer on steep slope; Yields from 3 to 20 gpm in fairly flat areas,may supply up to 50 gpm in low areas near source of recharge.
	Floyd Shale; includes Hartselle Sandstone Member at top, limestone unit at base.	100-2,000	Silt and clay shale, thin bedded siltstone and sandstone. Thickly to thinly bedded sandstone at top; massively bedded limestone at base.	Underlies broad valley areas and low hills where sandstone prominent. Hartselle Sandstone forms high ridges.	Wells in shale and thin sandstone average 80 feet deep, yield from 3 to 20 gpm. Water is soft to moderately hard; nearly half have high iron content. Wells in limestone unit may yield up to 50 gpm.
	Lavender Shale Member of Fort Payne Chert	0-200±	Shale; massively bedded mudstone and impure limestone.	Flanks of high ridges; broad low ridges, and some valley areas.	Wells on gentle slopes and low ridges yield 5 to 50 gpm from depths less than 150 feet. In valleys, yields may be as high as 100 gpm. Water is soft and low in iron content.
	Fort Payne Chert	10-200	Thinly to thickly bedded chert.	Steep ridge slopes; low ridges and rounded hills.	Where not steep, wells yield from 8 to 10 gpm. The water is soft to moderately hard; much has a high iron content.
Devonian	Chattanooga Shale and Maury Member	8-13	Shale	Mainly steep ridge slopes.	Not an aquifer. Contains iron and sulfide; should be cased off from wells.
	Armuchee Chert	125±	Thinly to thickly bedded chert.	Steep ridge slopes, rounded ridges and hills.	Same as Fort Payne Chert.
	Frog Mountain Sandstone	5-300±	Thinly to massively bedded sandstone and quartzite.	High ridges and dip slopes	Wells yield 0 to 10 gpm most areas, depending on topography; up to 50 gpm where thick and recharged by stream.
Silurian	Red Mountain Formation	600-1,200±	Thinly to massively bedded sandstone, shale.	High, generally steep sided strike ridges	Wells may supply up to 10 gpm on broad ridge crests; generally not available on narrow crested ridges.
Ordovician	Moccasin, Murfreesboro, Ridley, and Bays Formations undifferentiated	400±	Argillaceous limestone, mudstone, sandstone, quartzite, conglomerate, and shale.	Crops out on high ridges, ridge slopes, low hills.	Is an aquifer only in low lying areas of western Floyd County. Wells will yield from 2 to 20 gpm, depending on the amount of sandstone present. Water is soft, but may be high in iron.
	Rockmart Slate	0-600±	Slate, siltstone, sandstone and conglomerate.	Ridges and rolling hills.	Wells average 200 feet deep and yield from 1 to 30 gpm. The water varies from soft to hard, and generally is low in iron content.

	Deaton Member of Lenoir Limestone	100±	Ferruginous limestone and sandstone.	Valleys	Not an aquifer; should be cased off because of high iron content.
	Lenoir Limestone and Mosheim Member	35±	Thinly to massively bedded limestone.	Valley areas	Not developed as an aquifer; may supply some water to wells penetrating Rockmart Slate.
	Newala Limestone	300±	Thickly bedded limestone and dolomite.	Forms strike valleys.	Wells average 147 feet; yields generally run 5 to more than 20 gpm; some wells yield up to 1,500 gpm. Water is hard and of good chemical quality. Springs discharge large volumes of water, ranging in volume from 0.5 mgd to 15 mgd. The spring water is moderately hard to hard, low in iron, and is suitable for many industrial uses.
Cambrian and Ordovician	Knox Group	2,000-4,000±	Thickly to massively bedded cherty dolomite; some limestone. Thick chert and clay residuum.	Broad, gently to moderately rolling ridges.	Wells in bedrock average 160 feet deep and yield between 5 and 80 gpm. The water is low in iron and moderately hard to hard. Wells in residuum supply 1 to 15 gpm; the water is soft and of good quality. Several large springs discharge from this formation.
Cambrian	Conasauga Formation Eastern belt	1,500±	Shale and thickly bedded limestone.	Forms strike valleys.	Wells average 120 feet deep and yield from 2 to 25 gpm, but up to 300 gpm can be obtained from limestone. The water varies from soft to hard, and generally has a low iron content.
	Conasauga Formation Western belt	2,000±	Shale with limestone units.	Underlies a broad flat valley.	Wells less than 200 feet deep generally yield less than 10 gpm; wells 400 feet deep may supply 100 gpm. Dry wells occur. Water varies from soft to hard and some have a high iron and hydrogen sulfide content.
	Rome Formation	500-1,000±	Shale and interbedded sandstone, siltstone, and quartzite.	Moderately high strike ridges.	Wells average 100 feet deep; they yield 1 or 2 gpm where mainly in shale, mostly 5 to 10 gpm where sandstone and quartzite are common. Most of the water is soft; some contains high iron.
	Shady Dolomite	30-100±	Thick to massive dolomite; some shale.	Underlies scarp slopes; one small valley area.	Not an aquifer on scarp slopes; in valley it probably will supply from 5 to 50 gpm. The water will be hard, and probably will be low in iron.
Cambrian to Pennsylvanian	Talladega Slate	30,000±	Phyllite, quartzite, slate, graywacke.	Rolling country; rounded hills, steep valleys.	Wells generally less than 150 feet deep; yields vary with rock type: 0 to 5 gpm in phyllite; 10 to 25 gpm or more in quartzite and graywacke. The water generally is soft, and the iron content ranges from low to moderate; rarely high.

Table 2.--Chemical analyses of ground water, Floyd and Polk Counties, Ga.[1/]

Water-bearing formation: Mfs, Floyd Shale; Mfp, Fort Payne Chert; Mls, Lavender Shale Member of Fort Payne Chert; MDsc, Fort Payne, Frog Mountain, and Armuchee Formations undivided; MDc, Mississippian and Devonian chert undifferentiated; Dfm, Frog Mountain Sandstone; Da, Armuchee Chert; Ors, Sandstone, conglomerate, and slate in Rockmart Slate; Or, Slate and siltstone of Rockmart Slate; On, Newala Limestone; Od, Deaton Member of Lenoir Limestone; Oat, Attalla Conglomerate; O€k, Knox Group; €cd, Dolomite of Conasauga Formation; €c, Shale and limestone of Conasauga (Eastern belt); €csl, Shale and limestone of Conasauga (Western belt); €r, Rome Formation.

Well or Spring Number	Name or Owner	Water-bearing formation (Symbol refers to geologic map)	Depth of well (feet)	Date of Collection	Parts per million													Hardness as $CaCO_3$ 2/		Specific conductance (micromhos at 25°C)	pH
					Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved Solids (sum)	Calcium, magnesium	Non-Carbonate		
U. S. Public Health Service drinking-water standards						0.3		125					250	250	1.2	45	500				
Floyd County																					
3JJ11	A. D. Simpson	O€k	153	2-20-62	8.7	0.11	28	11.	1.3	0.4	137	0	2.8	1.5	0.0	1.5	131	115	2	220	7.9
5JJ11	Bill McKellan	€c	70	2-20-62	8.0	.10	30	19.	7.6	.5	172	0	5.2	11.	.0	5.6	169	153	12	320	7.7
5JJ13	Willis Bros., Inc.	€csl	42	3-30-62	13.	.07	20	1.9	2.8	.2	62	0	.4	6.0	.1	15.	103	58	7	154	7.0
5JJ33	Georgia Power Company	€csl	411	2-20-62	13.	.36	30	2.4	4.6	.5	93	0	16.	4.0	.0	1.7	119	85	9	190	7.4
5JJ21	C. G. Wall	€r	103	2-20-62	1.3	.07	16	3.2	1.8	5.3	76	0	.4	2.5	.1	1.0	75	53	0	120	7.0
3JJS4	Berry Schools	Mfs		2-20-62	7.8	.07	29	2.6	1.6	.5	99	0	3.6	1.5	.0	.1	97	83	2	170	7.6
5KKS1	Girl Scouts of America	MDc		3-30-62	7.1	.03	11	.5	1.1	.7	36	0	.8	1.5	.2	.1	54	30	0	66	7.0
3JJS1	Central of Georgia Railroad	Da		3-30-62	14.	.11	15	3.5	2.5	1.0	60	0	7.2	2.5	.2	.1	73	52	3	119	6.9
5JJS2	Morrison-Camp Ground Spring	O€k		3-21-62	6.6	.05	15	4.0	1.0	.6	65	0	.8	1.0	.2	.4	82	54	0	110	7.3
5HHS1	Wax Spring	O€k		3-20-63	6.7	.11	18	7.8	.8	.4	93	0	.4	1.0	.1	.9	96	77	1	141	7.3
4HHS1	Harry Marion Spring	O€k		3-30-62	7.8	.09	30	9.2	1.2	.6	134	0	.4	1.5	.2	1.0	140	113	3	218	7.7
3GGS1	Cave Spring	O€k		3-13-59	7.7	.04	25	12.	.4	.0	136	0	2.4	.5	.0	.7	126	112	0	208	7.9
3GGS1	do	O€k		3-30-62	9.2	.03	27	10.	1.1	.5	130	0	.0	1.0	.2	.3	128	109	2	210	7.5
3GGS2	Old Mill Spring	O€k		3-20-63	7.7	.01	22	9.5	.7	.4	112	0	1.2	1.0	.1	.3	100	94	2	163	7.4
4HHS2	Unknown	€cd		3-30-62	8.0	.12	31	7.9	1.2	.4	130	0	2.0	1.0	.1	.2	128	110	4	210	7.5
3JJS2	Joe Early	€csl		3-30-62	8.2	.07	26	2.7	1.5	.3	88	0	3.2	1.0	.1	.0	96	76	4	---	7.4
Polk County																					
6GG4	Cleo Brown	Mfp	143	5-17-63	9.6	.15	56	---	3.5	.6	202	0	7.2	3.0	.1	.0	187	168	2	322	7.2
5FF9	Walt Chandler	Ors	150	5-16-63	17.	1.1	2.0	---	3.8	.6	44	0	.4	1.8	.2	.0	54	32	0	75	6.5
3FF34	W. M. Holbrook	Or	39	5-17-63	19.	.79	72	---	12.	.6	188	8	12.	4.0	.3	.0	343	276	122	521	8.4
3FF25	W. D. Jarnell	Or	40	5-14-63	21.	2.6	5.2	---	8.7	.6	11	0	52.	4.5	.2	.0	109	57	48	160	5.8
3FF13	E. M. Mead	On	119	5-14-63	6.9	.05	22	---	1.6	.8	89	0	.0	2.0	.0	3.1	86	76	3	151	7.6
3FF15	Jewell Hulsey	On or top of O€k water may come from both	487	5-14-63	8.0	.10	34	---	1.7	.8	156	0	14.	2.5	.2	.0	152	144	16	268	7.9
3FF3	W. W. Corn	O€k	70	5-14-63	7.3	.09	24	---	2.0	.4	135	0	.0	1.5	.1	1.6	117	114	4	212	7.5
5GG1	Bob Harrison	O€k	130	5-17-63	8.2	.04	30	---	2.0	.5	158	0	2.4	3.5	.1	3.3	143	136	6	252	7.6
4GG3	Porter Crimes	O€k or €c	128	5-15-63	7.6	.16	22	---	2.2	.3	119	0	.0	2.0	.1	5.9	110	100	2	196	7.6
3GG40	R. Campbell	O€k	40	2-22-62	6.5	.33	1.6	.5	2.7	.8	4		.0	5.0	.0	4.2	29	6	2	36	5.6
5GGS4	Deaton Spring	On		3-19-63	8.0	.09	34	10.	1.2	.6	152	0	2.4	2.0	.1	2.4	150	128	4	217	7.6
4GGS3	Fish Spring	On		3-20-63	6.4	.06	22	6.6	2.0	.7	94	0	4.4	3.0	.1	3.5	100	82	5	154	7.4
5GGS3	Davette Spring	On		3-19-63	8.8	.08	30	13.	.8	.3	154	0	.8	1.5	.1	.8	144	130	4	215	7.7
5GGS1	Aragon Mills Spring	On		3-19-63	7.4	.05	37	12.	1.6	.6	162	0	4.0	3.0	.1	3.0	164	140	7	232	7.5
3GGS1	Cedartown Spring	On		11-27-57	9.2	.05	34	14.	2.2	.5	158	0	3.0	2.0	.4	4.0	157	142	5	264	7.4
3GGS1	do	On		3-19-63	8.2	.05	31	14.	2.0	.4	160	0	3.2	3.0	.1	3.7	160	136	5	224	7.7
3FFS1	West Spring	On		3-20-63	7.1	.05	18	7.1	.9	.4	88	0	.0	1.5	.1	1.2	74	4	2	139	7.2
3FFS3	Youngs Spring	O€k		3-20-63	8.3	.02	25	11.	1.3	.4	127	0	2.0	1.0	.1	.7	122	106	2	182	8.0

1/ Analyses by U. S. Geological Survey

2/ Water having a $CaCO_3$ hardness of 0 to 60 ppm is classified "soft"; 61 to 120 ppm, "moderately hard"; 121 to 180 ppm, "hard"; and more than 181 ppm, "very hard."

Table 3.--Spring flows in Floyd and Polk Counties, Ga.

Number	Name or Owner	Geologic source	Date measured or estimated	Flow (mgd)	Remarks
	Floyd County:				
2GGS1	Roy Williamon	Conasauga Formation	11/30/62	0.14 E.	
3GGS3	Unknown	Conasauga Formation	----	.04 E.	
4HHS2	Unknown	Conasauga Formation	----	.05 E.	
4HHS3	Pepperell Mfg. Co.	Conasauga Formation	10/12/50	.2	Used by industry
4HHS4	Pepperell Mfg. Co.	Conasauga Formation	3/09/64	.15 E.	Developed
4HHS5	Pepperell Mfg. Co.	Conasauga Formation	3/09/64	.10 E.	Developed
2JJS2	W. D. Vann	Conasauga Formation	11/09/61	.14+E.	Not used
5JJS1	Unknown	Conasauga Formation	10/26/61	.10 E.	
5JJS4	Hermitage	Conasauga Formation	10/26/61	.14 E.	Supplies 5 homes
5JJS6	Russell Spring	Conasauga Formation	10/12/50	.06	Undeveloped
5JJS7	Dempsey Brothers Dairy	Conasauga Formation	10/25/61	.10 E	Used by milk processing plant
5JJS8	Dempsey Brothers Dairy	Conasauga Formation	10/25/61	.10 E	Used by milk processing plant
5JJS10	J. W. Blankenship Mrs. Fred Dodd Mrs. Oline Parker	Conasauga Formation	10/25/61	.07 E	
3GGS2	Old Mill Spring	Knox Group	5/14/62 11/16/64	5. 4.8	Good industrial supply; would require large enclosure
3GGS4	Cave Spring	Knox Group	10/11/50 5/14/62 11/16/64	2.4 2.6 2.5	Supplies water to Cave Spring and Georgia School for the Deaf
4HHS1	Harry Marion Spring	Knox Group	10/11/50	1.3	Undeveloped
			10/12/62	1.2	
5HHS1	Wax Spring	Knox Group	11/16/64	.9	Seep spring; discharge from several outlets
5HHS2	J. R. Abrams	Knox Group	10/24/62	.14 E.	Supplies water for 5 homes
5HHS3	Luther Johnson & neighbors	Knox Group	10/24/62	.14 E.	Supplies community
5HHS4	Dan H. Norton	Knox Group	10/12/62	.14 E.	Furnishes dairy and 4 homes.
5JJS2	Morrison Camp Ground Spring	Knox Group	10/12/50	1.6	Partially enclosed; supplies Morrison Camp in summer
			11/18/64	.86	
5JJS3	Youngs Mill Spring	Knox Group	11/07/50	2.	Flows into lake; seep spring difficult to protect
			11/12/62	2.3	
5JJS5	Edwards Spring	Knox Group	10/12/50	.7	Undeveloped
			11/12/62	.7	
5JJS11	Harry Dawson	Knox Group	10/26/61	.05 E.	
3JJS1	Sand Spring	Floyd Shale	11/18/64	.3	Undeveloped

Table 3 (cont.)

Number	Name or Owner	Geologic source	Date measured or estimated	Flow (mgd)	Remarks
3JJS2	Joe Early	Floyd Shale	11/16/64	.3	Undeveloped
3JJS5	Beard Spring	Floyd Shale	10/17/50	1.	Undeveloped
			10/18/64	.9	
3JJS7	Berry Schools	Floyd Shale	10/24/61	.14 E.	Undeveloped
3JJS9	Mrs. Florence Masingal	Floyd Shale	10/09/61	.07 E.	Undeveloped
3JJS10	C. R. Smith	Floyd Shale	10/09/61	.07 E.	Domestic use
3KKS1	Buffington Spring	Floyd Shale	10/16/50	.2	Undeveloped
			11/18/64	.2 E.	
4KKS2	Arrowhead (Martin) Spring	Floyd Shale	10/13/50	0.30	Supplies Arrowhead Lake
			9/11/67	.47	
4KKS3	H. B. Hansard	Floyd Shale	10/02/61	.10 E.	Water used by 2 homes and dairy barn
5LLS3	Ted and Raford Barton	Floyd Shale	10/11/61	.04 E.	
5LLS4	Clyde Dunagan	Floyd Shale	10/11/61	.03 E.	
3JJS3	Rice Springs Farm	Fort Payne Chert	----	.60	Flow measured by consulting firm Undeveloped
4JJS4	Rice Springs Farm	Fort Payne Chert	----	1.	Flow measured by Roberts Engineering Corp. Undeveloped
4JJS1	Berry Schools	Fort Payne Chert	10/23/61	.07 E.	Not used
4JJS2	Berry Schools	Fort Payne Chert	10/23/61	.07 E.	Stock
4KKS1	Crystal Spring	Fort Payne Chert	10/11/61	.05 E.	
5LLS1	Girl Scouts of America	Fort Payne Chert	11/16/64	.2	Furnishes water for summer camp
5LLS2	Boy Scouts of America	Fort Payne Chert	10/11/61	.05 E.	Furnishes water for summer camp
2JJS1	M. S. Clay	Ordovician Limestone	11/09/61	.07 E.	
5JJS9	William Sims	Rome Formation	10/24/61	.07 E.	
3JJS6	Central of Georgia Railroad	Red Mountain Formation	11/16/64	.1 E.	Flows from pipe and concrete box
3JJS8	Thomas Berry Estate	Red Mountain Formation	11/09/61	.14 E.	Undeveloped
3JJS11	Berry Schools	Red Mountain Formation	10/23/61	.07 E.	Undeveloped
	Polk County:				
3FFS1	West (deep) Spring	Newala Limestone	8/21/50 11/17/64	1.0 .9	Undeveloped. Good location for industry
3FFS3	Freeman and William Bentley	Newala Limestone	4/30/63	.007 E.	Supplies dairy
4FFS1	E. E. Hudsputh	Newala Limestone	10/05/50	.3	Undeveloped
			11/18/64	.3 E.	
4FFS2	Unknown	Newala Limestone	----	---	Small flow
4FFS4	J. P. Everett	Newala Limestone	11/18/64	.3 E.	Furnishes home and dairy

Table 3 (cont.)

Number	Name or Owner	Geologic source	Date measured or estimated	Flow (mgd)	Remarks
4FFS5	E. C. Morgan	Newala Limestone	11/18/64	.5	Supplies dairy
5FFS1	R. E. Forsyth	Newala Limestone	5/16/63	.28 E.	Supplies 3 homes, restaurant and motel
3GGS1	Cedartown Spring	Newala Limestone	10/04/50	3.9	Supplies city of Cedartown
			10/18/54	2.9	
			11/17/64	2.8	
4GGS3	Hoyt Beck (Fish Spring)	Newala Limestone	10/05/50	.9	Largely filled in; requires enclosures to protect from flooding
			3/20/63	.3 E.	
5GGS1	Aragon Mills	Newala Limestone	10/05/50	.4	Supplies industry
			11/18/64	.35	
5GGS2	Aragon Mills	Newala Limestone	10/05/50	.7	Undeveloped
			11/18/64	.6	
5GGS3	Davette Spring	Newala Limestone	9/26/50	2.3	Undeveloped; beside Euharlee Creek but can be protected from surface water
			11/16/64	2.5	
5GGS4	Deaton Spring	Newala Limestone	9/25/50	15.6	This measurement made prior to spring being enclosed in concrete and may be the most accurate. Good location for industry
			5/12/66	6.5	Measurement: integrated computation from point velocity readings
			6/06/66	10.2	Difference in flow of Euharlee Creek upstream and downstream from the spring
			6/06/66	9.0	Measure of water flowing through pipe from enclosures; does not include a considerable volume of leakage
3FFS2	R. T. McCoy	Knox Group	4/30/63	.28 E.	Supplies 2 homes, dairy and chicken houses
4FFS3	Youngs Spring	Knox Group	10/05/50	.6	Near railroad; requires enclosure to protect from surface water
4FFS6	Philpott Spring	Knox Group	8/21/50	.08 E.	Undeveloped
4GGS1	Jones Spring	Knox Group	10/05/50	.4	Undeveloped
			11/17/64	.4 E.	
4GGS2	Locke Spring	Knox Group	8/22/50	.3	Undeveloped
			11/17/64	.3 E.	
6GGS1	Paul McKelvey	Fort Payne Chert	10/06/50	.2	Undeveloped

Table 4.--List of graptolites from the Rockmart Slate, indicated by localities

	Locality Numbers[1/]									
	1	2	3	4	5	6	7	8	9	10
Climacograptus riddellensis Harris					X					
C. riddellensis Harris ?				X						
C. aff. *C. riddellensis* Harris					X				X	
C. cf. *C. riddellensis* Harris	X		X							X
C. cf. *C. scharenbergi* Lapworth			X					X		
C. n. sp. (like *C. marathonensis*)	X		X							X
C. sp. (of the *C. angulatus* Bulman type)								X		
C. sp. (of the *C. riddellensis* type)							X			
C. sp.			X							
Cryptograptus schaferi Lapworth	X									
C. tricornis (Carruthers)		X	X							
Didymograptus cf. *D. paraindentus* Berry			X							
D. cf. *D. robustus* var. *norvegicus* Berry					X					
D. cf. *D. tornquisti* Reudemann			X							
Glossograptus ciliatus Emmons?			X							
G. hincksii (Hopkinson)			X							
G. sp.		X		X	X		X		X	
Glyptograptus euglyphus						X				
G. euglyphus (Lapworth)		X			X		X	X	X	X
G. euglyphus cf. var. *sepositus* (Keble and Harris)			X							
G. aff. *G. euglyphus* (Lapworth)				X						
G. cf. *G. euglyphus* (Lapworth)										X
G. aff. *G. euglyphus* var. *sepositus* (Keble and Harris)		X								
G. cf. *G. euglyphus* var. *sepositus* Harris and Keble								X		
G. aff. *G. teretiusculus* (Hisinger)			X					X		X
G. aff. *G. teretiusculus* var. *siccatus* (Ellis and Wood)	X									X
G. cf. *G. teretiusculus* (Hisinger)									X	X
G. cf. *G. teretiusculus* var. *siccatus* (Ellis and Wood)			X			X				
G. sp.				X	X			X		
G. ? sp.								X		X
Hallograptus inutilis (Hall)				X						
H. cf. *H. mucronatus* (Hall)								X		
Isograptus sp. (of the *I. caduceus* type)				X						
Pterograptus n. sp. (similar forms occur in the Australian Darriwil *Glyptograptus teretiusculus* Zone)					X					
Retiograptus aff. *R. speciosus* Harris					X					
R. cf. *R. speciosus* Harris (one specimen identical to some from highest Darriwil age locality *Glyptograptus teretiusculus* Zone in Victoria, Australia)		X								X
R. sp.			X					X		X
R. ? sp.	X									
Trigonograptus sp.								X		

1/ localities described in text.

Table 5.--Middle Ordovician graptolite zones of Berry (1960)

	Locality Number									
	1	2	3	4	5	6	7	8	9	10
Zone 12 = *Climacograptus bicornis*	?	?					?	?	?	?
Zone 11 = *Nemagraptus gracilis*	?	?					?	*	?	?
Zone 10 = *Glyptograptus teretiusculus*	*	*	*	*	*	*	*	?	*	*
Zone 9 = *Hallograptus etheridgei*		?		?	?	?				

* most probable

? possible

Table 6.-- Record of wells in Floyd County, Georgia

Geologic symbol: Mb, Bangor Limestone; Mfs, Floyd Shale; Mfp, Fort Payne Chert; Mls, Lavender Shale Member of Fort Payne Chert; MDc, chert of Mississippian and Devonian age; Da, Armuchee Chert; Srm, Red Mountain Formation; On, Newala Limestone; O€k, Knox Group; €cd, dolomite of Conasauga Formation; €c, shale and limestone of Conasauga (Eastern belt); €csl, shale and limestone of Conasauga (Western belt); €cls, limestone and some shale of Conasauga (Western belt); €cl, limestone of Conasauga; €cs, shale and sandstone of Conasauga (Western belt); €r, Rome Formation.

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
2GG5	C. C. Montgomery	Drilled	Slope	€cd-€r	6	68.5	32	24	1952	---	Domestic and stock	
6	J. E. Dempsey	Drilled	Slope	€csl	6	214	10	--	----	---	Store	Well pumped dry, 3 hours continuous pumping
7	J. E. Dempsey	Drilled	Slope	€cls	6	150	14	10	1956	---	Domestic and stock	
8	Glenn Montgomery	Drilled	Slope	€r?	6	74	70	--	----	---	Domestic	
9	Mrs. Lois Ellis	Drilled	Slope	€r?	6	70	55±	10	1961	---	Stock	
3GG41	Shelton Lindsey	Drilled	Hillside	€cd	6	48	33	22	1962	15	Domestic and stock	
42	O. H. Shaw	Drilled	Hillside	€cd	6	99.5	60	--	----	50	Domestic and stock	
43	J. A. Dempsey	Drilled	Flat	€cd	6	72	36	23	1958	---	Domestic	
44	Mrs. Paul Sewell	Drilled	Slope	€cd	6	80	40	20	1958	20+	Domestic and stock	
45	Mrs. Paul Sewell	Drilled	Slope	€cd	6	65	--	55	1950	---	None	Water muddies
46	Roy Tallent	Drilled	Slope	€cd	6	82	70	--	----	---	Domestic and stock	Water muddies
47	Bill Davis	Drilled	Slope	Lower O€k	6	223	--	175	1959	35+	Domestic and stock	
48	W. J. Williams	Drilled	Slope	O€k	6	235	--	25	1962	---	Stock	Water muddies
49	W. J. Williams	Drilled	Slope	O€k	6	295	--	209	1962	---	Domestic and stock	
4GG66	Miss Ruth Couch	Drilled	Slope	O€k, lower	6	230	--	--	----	---	Domestic and stock	Water muddies
67	W. B. Justice	Drilled	Slope	Lower O€k	6	111	111	101	1962	12	Domestic and stock	
68	Henry H. Jones, Jr.	Drilled	Slope	O€k	6	185	185	--	----	7	Domestic	Some iron
69	W. L. Duke	Drilled	Slope	O€k, lower	6	150	150	--	----	---	Domestic	Some iron
70	Clifford Bell	Drilled	Slope	€c	6	135	--	--	----	---	Domestic	
71	R. S. Shiflett	Drilled	Slope	Lower O€k or €c-on fault	6	161	151	126	1956	---	Domestic	Some iron
72	Mrs. A. D. Miller	Drilled	Slope	Lower O€k	6	96	95	--	----	---	Domestic	

Table 6 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
4GG 73	C. V. Chisolm	Drilled	Slope	Lower O€k	6	80	80	20	1962	---	Domestic	
74	E. Jack Barron	Drilled	Hillside	Lower O€k	6	500	128	170	1960	8	Domestic and stock	
75	E. Jack Barron	Drilled	Slope	€c (?)	6	360	--	--	----	---	Stock	Some iron
76	S. R. Eden	Drilled	Flat	Lower O€k	6	140	90	--	----	---	Domestic and stock	
5GG63	J. L. Camp	Drilled	Slope	Lower O€k	6	90	--	50	1962	---	Domestic	
64	J. A. Upthegrow	Drilled	Slope	O€k	6	278	54	30	1962	4	Domestic and stock	
65	J. M. Gribble	Drilled	Slope	Upper O€k	6	78	78	38	1959	---	Domestic	Water muddies
66	M. H. Edwards	Drilled	Slope	Upper O€k	6	150	--	52	1959	16	Domestic	
67	Richard Haney	Drilled	Slope	Upper O€k	6	311	60	--	----	---	Domestic	
68	J. A. Ballanger and Clyde Gribble	Drilled	Slope	Upper O€k	6	87	--	--	----	---	Domestic	
69	Wallace R. Agon	Drilled	Slope	On	6	139	70	--	----	14	Domestic and stock	
70	Earl and Charles Brumbelow	Drilled	Slope	Upper O€k	6	179	179	80	1956	---	Domestic	
71	Mrs. D. S. McCluney	Drilled	Slope	Upper O€k	6	160	155	--	----	---	Domestic and stock	
2HH1	Marion Little	Drilled	Flat	€c	6	126	45	21	1961	---	Domestic	
2	W. M. Clemonec	Drilled	Flat	€c shale	4	100	--	--	----	---	Domestic and stock	
3	C. L. Burnett	Drilled	Slope	€c shale	6	110	20	24	1956	6	Domestic	
4	H. L. Freeman	Drilled	Slope	€c	6	118	35	83	1954	4	Domestic and stock	
5	Joe Allen George	Drilled	Slope	€c	6	72	20	25	1959	6	Domestic and stock	
3HH1	Sam Pearson	Drilled	Slope	Mfp	6	162	70	--	----	7	Domestic and stock	
2	F. E. Western	Drilled	Slope	Mfp	6	148	100	106	1955	---	Domestic	
3	L. L. Puckett	Drilled	Slope	€csl	6	125	31	27	1960	5	Domestic	
4	T. J. Crews	Drilled	Slope	€csl	6	81	42	21	1959	---	Domestic	
5	Luther Murphy	Drilled	Slope	O€k	6	80	20	14	1960	---	Domestic	
6	M. E. & W. L. Pruitt and R. L. Jones	Drilled	Slope	O€k	6	182	9	20	1956	---	Domestic	
7	B. T. Jenkins	Drilled	Slope	O€k	6	120	30	--	----	6	Domestic	
8	W. T. Nicholls	Drilled	Slope	O€k	6	127	42	46	1962	15	Domestic and stock	
9	S. B. Simms	Drilled	Slope	O€k	6	265	190	40	1954	6	Domestic	
10	R. C. Vann	Drilled	Slope	O€k	6	80	50	20	1960	10	Domestic	

Table 6 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
3HH11	L. F. Bing	Drilled	Slope	O€k	6	100	20	18	1958	---	Domestic	Milky
12	Clayton White	Drilled	Slope	O€k	6	300+	24	--	----	---	Domestic	
13	C. T. Blankenship	Drilled	Slope	O€k	6	102	25	20	1955	10	Domestic	
14	R. C. Vann	Drilled	Slope	O€k	6	78	20	15	1960	10	Domestic	
15	C. D. Covey	Drilled	Slope	O€k	6	120	21	4	1963	10	Domestic	
16	Alvin Covey	Drilled	Slope	O€k	6	75	30	4	1959	15	Domestic and stock	
17	F. M. King	Drilled	Slope	O€k	6	68	5	5	1955	10	Domestic and stock	
18	H. C. Cantrell	Drilled	Slope	O€k	6	130	15	20	1962	60	Domestic	
19	Jack Montgomery	Drilled	Hilltop	€cd	6	100	80	35	1957	50	Domestic and stock	
20	Pine Ridge Dairy	Drilled	Flat	€cd	6	105	30	--	----	---	Domestic and stock	
21	W. D. House	Drilled	Slope	€cd	6	53	52	30	1962	10	Domestic	
22	Ed. E. Perkins	Dug	Flat	€cd	48	22	--	16	1962	10	Domestic and stock	
23	Mrs. W. J. Martin	Drilled	Flat	€cd	6	57	--	--	----	4	Domestic	
24	J. W. Salmon	Drilled	Slope	€csl	6	95	17	85	1961	60	Domestic	
25	Marvin Fortenberry	Drilled	Slope	€csl	6	71	14	--	----	8	Domestic	
26	Thurman Chandler	Drilled	Flat	€csl	6	103	--	13.14	1945	10±	Stock	
27	Sidney Evans	Drilled	Slope	€csl	6	129	50	--	----	9	Domestic	Some iron
28	H. D. Norman	Drilled	Slope	Mfp-Mfs	6	91	60	--	----	6	Domestic	
4HH1	Henry Fincher	Drilled	Slope	€c	6	67	33	16	1950	50	Domestic and stock	
2	D. F. Ellis	Drilled	Slope	Lower O€k	6	175	170	154	1962	---	None	
3	Valley View Rest Home	Drilled	Slope	€c	8	97	--	35	1959	---	Domestic	
4	J. J. Rush	Drilled	Slope	€c	8	346	40	40	1961	---	Domestic	43 homes
5	W. R. Stephens	Drilled	Slope	€c	6	186	25	42	1955	---	Domestic and stock	
6	Floyd County Board of Education	Drilled	Slope	Lower O€k	6	200	--	--	----	50	Domestic	
7	Lawrence Gaus	Drilled	Slope	Lower O€k	6	217	200	--	----	---	Domestic	This well goes dry at times
8	Roy Tillery	Drilled	Slope	Lower O€k	6	372	--	172	1958	5	Domestic and stock	
9	Pleasant Hope Baptist Church	Drilled	Flat	€c	6	300	--	--	----	---	Domestic and stock	
10	G. S. Bailey	Drilled	Flat	€c	6	87	87	67	1954	10+	Domestic and stock	

Table 6 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
4HH11	F. Pullen	Drilled	Slope	€c - O€k	6	56	28	23	1962	---	Domestic	
12	H. J. Burkhalter	Drilled	Slope	€c	6	187	84	30	1962	14+	Domestic	
13	H. J. Burkhalter	Drilled	Slope	€c	6	76	--	--	----	---	Domestic	
14	H. J. Burkhalter	Drilled	Slope	€c	6	74	--	--	----	8	Domestic	
15	F. M. Willis	Drilled	Flat	Lower O€k	6	110	--	--	----	15+	Domestic	
16	G. T. Haney	Drilled	Slope	Lower O€k	6	147	141	117	1956	12	Domestic	
17	F. M. Willis	Drilled	Flat	Lower O€k	6	75	--	35	1962	15+	Garden	
18	Jack Weems	Drilled	Hillside	€c	6	148	32	30	1951	---	Domestic	
19	Robert Shoemaker	Drilled	Hillside	€c	6	140	126	80	1962	---	Domestic and stock	
20	J. C. Price	Drilled	Hillside	€d	6	76	45	--	----	10+	Domestic	
21	J. D. Smith	Drilled	Flat	€c	6	52	40	8	1962	8	Domestic	
22	D. H. Jones	Drilled	Hillside	€c	6	120	--	80	1958	---	Domestic	
23	J. D. Kenrick	Drilled	Flat	€c	6	104	67	32	1960	---	Domestic	
24	Mrs. Lucille Davis	Drilled	Hilltop	€c	6	65	55	--	----	---	Motel and restaurant	
25	J. R. Roberts St.	Drilled	Slope	€cl	6	108	35	71	1928	10	Domestic and stock	
26	J. H. Smith	Drilled	Slope	€c	6	68	50	20	1962	---	Motel and store	
27	J. H. Powell	Drilled	Slope	€c	6	79	30	31	1956	---	Domestic	
28	Robert Walther	Drilled	Hillside	MDc	6	93	--	76	1958	32	Domestic	Water muddies
29	J. W. Parker	Drilled	Slope	€csl	6	181	93	35	1959	5	Domestic	
30	Eddie Crider	Drilled	Slope	Mls - on Rome fault	6	95	33	30	1962	7	Domestic	
31	R. T. Burchett	Drilled	Flat	€cls (flood plain of river)	6	80	40	20	1962	---	Drinking	
32	Paul Cannon	Drilled	Slope	MDc - on Rome fault	6	81	45	24	1957	---	Domestic	Drill dropped 18 feet
33	William Hoffman	Drilled	Slope	MDc - on Rome fault	6	140	40	30	1960	30	Domestic	
34	Joe B. Mulinix	Drilled	Slope	MDc-€csl - on Rome fault	6	130	105	55	1948	6	Domestic	
35	H. W. Fountain	Drilled	Hillside	€cs	6	175	16	16	1963	8	Domestic	
36	Horace W. Popham	Drilled	Slope	€cd	6	105	--	--	----	---	Domestic	

Table 6 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
4HH 37	Jomen W. Terry	Drilled	Hillside	Lower O€k	6	137	120	50	1959	7	Domestic	Muddies during heavy rains
38	T. A. Green	Drilled	Hillside	Lower O€k	6	80	78	64	1959	12	Domestic and stock	
39	A. W. Horton	Drilled	Slope	€cls	6	138	43	38	1962	15	Domestic and stock	
40	Pepperell Mfg. Co.	Drilled	Slope	€c	6	275	--	--	----	---	Industrial	
41	Pepperell Mfg. Co.	Drilled	Slope	€c	6	153	--	--	----	---	Industrial	
42	Pepperell Mfg. Co.	Drilled	Slope	€c	6	126	--	--	----	---	Industrial	
43	Pepperell Mfg. Co.	Drilled	Slope	€c	6	126	--	--	----	---	Industrial	
44	Pepperell Mfg. Co.	Drilled	Slope	€c	6	75	--	--	----	---	Industrial	
5HH1	J. T. Traylor	Drilled	Hillside	Lower O€k	6	120	120	55	1960	---	Domestic	
2	K. N. Tate	Drilled	Hillside	Lower O€k	6	143	143	70	1958	40	Domestic and stock	
3	J. A. Ingram	Drilled	Hillside	O€k - lower?	6	41	41	27	1961	---	Domestic	
4	J. M. Ingram	Drilled	Hillside	Lower O€k	6	80	70	20	1957	10	Domestic and stock	
5	R. B. Emerson	Drilled	Slope	Lower O€k	6	108	100	75	1952	11	Domestic and stock	
6	Lewis W. Sullins	Drilled	Slope	Lower O€k	6	104	100	54	1957	20	Domestic	
7	C. W. Kerce	Dug	Slope	Lower O€k	36	60	60	50	1962	---	Domestic and stock	
8	J. E. Abernathy	Drilled	Slope	Lower O€k?	6	312	70	60	1956	20	Domestic and stock	
9	David Vaughn	Drilled	Slope	Lower O€k	6	472	74	100	1952	---	Domestic and stock	
10	Eugene Evans	Drilled	Slope	Lower O€k	6	120	105	--	----	7	Domestic and stock	
11	B. H. Braden	Drilled	Slope	Lower O€k	6	135	--	92	----	12	Domestic and stock	
12	Earl Spain	Drilled	Hillside	Lower O€k	6	75	75	--	----	---	Domestic	
13	Mrs. Lodie Rogers	Drilled	Hillside	Lower O€k	6	130	--	30	1959	---	Domestic and stock	
14	Spring Creek Baptist Church	Drilled	Hillside	Lower O€k	6	90	--	--	----	---	Domestic	
15	J. W. Thrash	Drilled	Hillside	Lower O€k	6	103	90	50	1962	30	Domestic	
16	Mrs. G. F. Rogers	Drilled	Hillside	Lower O€k	6	126	126	--	----	---	Domestic and stock	
17	Tom Carroll	Drilled	Hillside	Lower O€k	6	278	--	70	1962	17	Domestic and stock	
18	John Ellington	Drilled	Hillside	Lower O€k	6	113	110	25	1962	---	Domestic	
19	W. C. Lloyd	Drilled	Hillside	Lower O€k	6	92	85	26	1952	60	Domestic and stock	
20	R. E. Mitchell	Drilled	Hillside	Lower O€k	6	87	85	30	1958	---	Domestic	
21	Grady Cook	Drilled	Hillside	Lower O€k	6	100	--	--	----	20	Domestic	

Table 6 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
5HH 22	T. P. Mull	Drilled	Hillside	Lower O€k	6	120	100	60	1961	---	Domestic and stock	
23	B. F. Shell	Drilled	Hillside	Middle O€k	6	136	136	94	1960	4	Domestic	
24	E. R. Brownlow, Jr.	Drilled	Hillside	Middle O€k	6	446	165	100	1959	3	Domestic and stock	
25	G. W. Hall	Drilled	Hillside	Lower O€k	6	293	58	230	1962	7	Domestic and stock	
26	Mrs. A. T. Bailey	Drilled	Slope	Lower O€k	6	125	120	--	----	8	Domestic	
27	Leroy Wilbanks	Drilled	Slope	Lower O€k	6	167	167	122	1951	20	None	Water muddies
28	Leroy Wilbanks	Drilled	Slope	Lower O€k	6	131	131	24	1962	---	Domestic and stock	Water muddies
29	Robert W. Rhyme	Drilled	Slope	Lower O€k	6	101	101	--	----	5	Domestic	
30	Mrs. Ruth Litton	Drilled	Slope	Lower O€k	6	60	--	25.67	1962	---	Domestic and stock	
2JJ1	Q. M. Carroll	Drilled	Hillside	€csl	6	225	70	--	----	---	Domestic	
3JJ1	L. J. Dunaway	Drilled	Slope	Mfs or Mls	6	84	79	25	1955	20	Domestic and stock	
2	Lewis B. Payton	Drilled	Slope	Mfs	6	84	79	25	1955	20	Domestic and stock	
3	Howard Cordle	Drilled	Slope	Mfs	6	85	65	At lsd	1959	---	Domestic and stock	Sulfur
4	Antioch Baptist Church	Drilled	Slope	Mfs	6	60	21	--	----	---	Domestic	
5	Sara McIntyre	Drilled	Slope	Mfs	6	85	12	30	1961	---	Domestic	
6	C. D. Buffington	Drilled	Slope	Mfs	6	50	42	--	----	---	Domestic and stock	
7	Howard Mathis	Drilled	Slope	Mfs	6	60	--	14	1961	---	Domestic	
8	W. M. Cargle	Drilled	Slope	Mfs.	6	69	40	20	1957	16	Domestic and stock	
9	G. W. Boggs	Drilled	Hillside	Mfs	6	65	--	Flows	1961	---	Domestic	
10	G. H. White	Drilled	Slope	O€k or Da	6	60	45	17	1954	1	Domestic and stock	
11	A. D. Simpson	Drilled	Slope	O€k	6	153	--	120	1961	27	Domestic and stock	
12	Dewey H. Worthy, Jr.	Drilled	Flat	Mfs	6	60	55	15.33	1961	10	Domestic	
13	Arthur W. Lloyd	Drilled	Flat	Mfs - €c on fault	6	72	28	15	1955	15	Domestic	
14	Mrs. Arthur T. Lloyd	Drilled	Flat	€c	6	87	21	4	1948	16	Domestic	Some iron
15	Rome Kraft	Drilled	Hillside	Mfs	6	205	179	40	1958	6.5	Domestic	Some iron
16	C. W. Apridge	Drilled	Slope	Mfs (?)	6	89	7	--	----	10	Domestic	
17	C. W. Apridge	Drilled	Slope	Mfs (?)	6	157	--	--	----	10	Domestic	
18	C. H. Jonson	Drilled	Slope	Mfs	6	96	35	33.28	1961	--	None	Some iron
19	C. W. Apridge	Drilled	Hilltop	Mfs (?)	6	359	--	29.20	1946	--	Domestic	

Table 6 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
3JJ 20	Jack Apridge	Drilled	Slope	Ꞓc	6	65	--	--	----	10	Domestic	
21	George Benton	Drilled	Slope	Mfs	6	80	21	30	1959	13	None	
22	Oliver Montague	Drilled	Slope	Mfs	6	150	21	30	1959	13	None	
23	A. J. Holden	Drilled	Flat	Mfs	6	75	18	10	1955	9	Domestic	
24	Hardin and Holden	Drilled	Slope	Mfs	6	65	20	15	1956	---	Domestic	
25	W. F. Riley	Drilled	Hillside	Mfs	6	71	29	20	1957	---	Domestic	Some iron
26	W. H. Shakleford	Drilled	Slope	Mfs	6	58.5	21	15	1953	18	Domestic	
27	W. H. Wood	Drilled	Slope	Mfs	6	79	40	30	1957	---	Domestic	Some iron
28	Ray Myers	Drilled	Slope	Mfs	6	75	50	12	1955	---	Domestic	Some iron
29	Oconee Clay Products	Drilled	Flat	Mfs	6	74	21	30	1954	9	Domestic	
30	E. T. Coalson	Drilled	Hillside	Mfs	6	110	80	30	1954	9	Domestic and stock	
31	Miss Ruth Bridges	Drilled	Slope	Mfs	6	96	20	20	1961	10	Domestic	
32	Claude H. Haire	Drilled	Flat	Mfs	6	121	35	8	1960	9	Domestic and stock	
33	O. S. Underwood	Drilled	Flat	Mfs	6	68.5	--	--	----	6	Domestic	
34	H. G. Block	Drilled	Hillside	Mls	6	72.5	66	10	----	7	Domestic	
35	Georgia Power Co.	Drilled	Flat	Ꞓcsl	12	411	44.5	20	1955	69.6	Industrial	
36	Rice Spring Farms	Drilled	Hilltop	Mfs	6	152	--	--	----	51	Domestic and stock	
37	Rice Spring Farms	Drilled	Slope	Mls	6	135	132	--	----	---	Domestic and stock	
38	A. A. Looney	Drilled	Slope	Srm	6	159	40	Ground-level	----	---	Domestic	Flows in winter
39	C. E. Espy	Drilled	Slope	Mfs	6	76	25	8	----	---	Domestic	Flows in winter
40	Georgia Power Co.	Drilled	Flat	Ꞓcsl	12	405	--	15	----	40	Industrial	GGS 259
4JJ1	James F. Selman	Drilled	Slope	Mb	6	70	45	25	1960	8	Domestic	
2	Thomas J. Cordle	Drilled	Slope	Mfs	6	62	21	--	----	---	Domestic	
3	Jodie Hawkins	Drilled	Slope	Mfs	6	170	--	--	----	---	Domestic and stock	
4	Harold G. Eleam	Drilled	Slope	Mfs	6	46	21	21	1955	---	Domestic	Some iron
5	Max Worley	Drilled	Slope	Mfs	6	78	--	15	1961	---	Domestic and stock	Some iron
6	J. Hudson Davis	Drilled	Slope	Mfs	6	71	21	10	1957	15	Domestic	
7	Raymond Davis	Drilled	Slope	Mfs	6	62	21	12	1955	---	Domestic	
8	C. L. Hicks	Drilled	Slope	Mfs	6	50	42	18	1959	22	Domestic	

Table 6 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
4JJ 9	H. E. Thompson	Drilled	Slope	Mfs	6	60	30	1	1961	---	Domestic	Some iron
10	Albert Smith	Drilled	Slope	Mfs	6	80	18	6	1957	---	Domestic and stock	
11	Earl Yarborough	Drilled	Slope	Da	6	86	30	6	1961	20	Domestic	
12	C. C. Lynch	Drilled	Slope	Mfs	6	60	21	At lsd	1961	---	Domestic	Some iron
13	Earl Yarborough	Drilled	Slope	Mfs	6	89	52	30	1954	10+	Domestic	Some iron
14	J. T. Winslett	Drilled	Slope	Mfs	6	66	--	10	1961	10	Stock	
15	E. O. Woodfin	Drilled	Slope	Єcsl	6	120	76	10	1957	10	Domestic	
16	J. D. Cayle	Drilled	Flat	Єcsl	6	96	21	18	1959	---	None	
17	J. L. Hall	Drilled	Slope	Єcsl	6	80	40	18	1953	20	Domestic	
18	Roy Selman	Drilled	Flat	Єcsl	6	67	28	14	1949	---	Water grass	Some iron
19	C. C. Lynch	Drilled	Flat	Єcsl	6	100	18	18	1961	---	Domestic	
20	Mr. Gresham	Drilled	Slope	Єcsl	6	94	18	10	1946	---	Domestic	
21	C. G. Wall	Drilled	Slope	Єr	6	103	70	18	1957	10	Domestic	QW analyses
22	J. Howard Ford	Drilled	Slope	Єc	6	189.5	101	20	1950	10	Domestic and stock	
23	James H. Ellis, Jr.	Drilled	Hillside	Єr	6	97	92	30	1956	20	Domestic	Some iron
24	Joe Aycock	Drilled	Flat	Mfs	6	50	12	15	1957	10+	Domestic	Some iron
25	Idas Adams	Drilled	Flat	Mfs	6	107	105	82	1944	---	Domestic	
26	Pure Oil Company	Drilled	Flat	Mls	6	86	26	10	1946	12	Domestic	Flows in winter
27	W. W. Purdy	Drilled	Slope	Mfs	6	54	52.5	--	----	---	Domestic	
5JJ1	Jerry Johnson	Drilled	Slope	Lower OЄk	6	135	--	55	1961	---	Domestic	
2	Redmond Ransom	Drilled	Slope	Єc	4	150	150	80	1962	---	Domestic	
3	A. L. Paris	Drilled	Slope	Єc	6	164	60	30	1945	6	Domestic	
4	Bill McKellor	Drilled	Slope	Єcl	6	71	24	18	1949	9	Domestic	
5	J. E. Gaines	Drilled	Slope	Єc	6	69	20	15	1948	15	Domestic and stock	
6	William A. Gaines	Drilled	Slope	Єc	6	85	10	4	1949	---	Domestic	
7	Jessie Burch	Drilled	Slope	Єc	6	32	32	--	----	17	Domestic	
8	J. T. Culberson	Drilled	Slope	Єc	6	243	18	15	1958	---	Domestic	
9	J. T. Culberson	Drilled	Flat	Єc	6	50	17	12	1953	---	Domestic	
10	Bill McKellor	Drilled	Flat	Єc	6	100.6	42	18	1961	---	None	

Table 6 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
5JJ11	Bill McKellor	Drilled	Flat	€c	6	70	20	10	1942	---	Domestic	
12	Monroe Caine	Drilled	Slope	€csl	6	72	--	12	1961	---	Domestic and stock	
13	William E. Dawes	Drilled	Slope	€csl	6	81	19.5	12	1961	10	Domestic and stock	
14	J. R. Dempsey	Drilled	Slope	Lower O€k	6	130	120	60	1960	---	Domestic	
15	Glenn Davis	Drilled	Slope	€csl	6	83	30	23	1950	---	Domestic	
16	William Otto Dutton	Drilled	Slope	€csl or Mfs	6	100.5	--	--	----	---	Domestic	
17	Ben Johnson	Drilled	Flat	€r	6	140	80	50	1960	---	None	
18	James T. Johnson	Drilled	Slope	€r	6	80	--	14	1954	---	Domestic	
19	William J. Wosely	Drilled	Hillside	€r	6	120	42	30	1961	---	Domestic	
20	Floyd County Board of Education	Drilled	Hillside	Lower O€k	6	170	170	110	1940	16	School	
21	Hubert H. Vaughan	Drilled	Hillside	€c or €r	6	122	100	40	1961	---	Yard	
22	N. V. Crowder	Drilled	Flat	€c	6	280	12	12	1959	10	Stock	Water muddies
23	J. L. Bishop	Drilled	Hillside	Lower O€k	6	209	186	167	1959	5+	Domestic	Water muddies
24	C. A. Teague	Drilled	Slope	Lower O€k	6	225	--	125	1941	---	Domestic	
25	B. R. Grogan	Drilled	Hillside	Lower O€k	6	478	110	90	1961	25	Domestic and stock	
26	J. T. Stower	Drilled	Hillside	Lower O€k	6	150	142	98	1955	10	Domestic	
27	Henry Sherman	Drilled	Hillside	Lower O€k	6	160	160	75	1958	15	Domestic	
28	Southeastern Pipeline Company	Drilled	Flat	€c or O€k	4	363	360	10	1961	32	None	Water muddies
29	C. C. Davis & Bro.	Drilled	Slope	€c	6	100	8	13	1961	20	Domestic and stock	
30	C. C. Davis & Bro.	Drilled	Slope	€c	6	70	12	26	1957	---	Domestic and stock	
31	Burt Dempsey, Jr. & Brother	Drilled	Slope	€c	6	159	16	20	1961	17	Domestic	
32	Russell Cochran	Drilled	Flat	€c	6	66	--	40	1957	---	Domestic	
33	F. A. Webb	Drilled	Slope	€c	6	64	58	6	1960	10	Domestic	
34	J. M. Lumpkin	Drilled	Slope	Lower O€k	6	148	148	118	1960	---	Domestic and stock	
35	Floyd Carner	Drilled	Slope	Lower O€k	6	136.5	126	40	1950	9+	Domestic	
36	Will Waters	Drilled	Slope	€c	6	130	112	70	1957	---	Domestic	
37	J. W. Sherman	Drilled	Slope	Lower O€k	6	135	135	--	----	10	Domestic and stock	
38	Willis Bros., Inc.	Drilled	Slope	€csl	6	50	30	8	----	20	Domestic and stock	

Table 6 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
5JJ 39	Willis Bros., Inc.	Drilled	Slope	€csl	6	42	39	10	----	12	Industrial	
40	Edna Gaines	Drilled	Slope	€csl	6	188	20	75.4	1961	---	None	
41	John Kearse	Drilled	Hillside	O€k	6	187	181	135	----	6	Domestic and stock	
42	S. N. Whatley	Drilled	Slope	€c	4	60	30	20	----	15	Domestic and stock	
3KK1	Estate of Mabel Duncan	Drilled	Slope	Mfs or Mls	6	70	--	20.30	1961	---	Domestic	Some iron
2	Walter Blanton	Drilled	Hillside	Mfs	6	113	110	68	1961	---	Domestic	
3	H. T. Davis	Drilled	Hillside	Mfs	6	64	--	44	1961	---	Domestic and stock	
4	R. E. Milstead	Drilled	Hillside	Mfs	6	105	63	25	1956	---	Domestic	
4KK1	S. I. Storey Lmbr. Co.	Drilled	Slope	Mfs or Mls	6	205	205	130	1947	---	Domestic	Water muddy most of time
2	Benard Storey	Drilled	Hillside	Mfs or Mls	6	130	130	30	1957	---	Domestic	
3	Storey Lmbr. Co.	Drilled	Slope	Mls	6	63	63	23	1954	---	Domestic	
4	T. W. Manes	Drilled	Slope	MDc	6	105	42	40	1960	---	Domestic	
5	T. S. Selman	Drilled	Slope	Mfs	6	83	21	20	1959	---	Domestic and stock	Some iron
6	Gordon Scoggins	Drilled	Slope	Mfs	6	57	21	12	1947	20	Domestic and stock	
7	Carl W. Carney	Drilled	Slope	Mfs	6	102	30	--	----	---	Domestic and stock	Iron, bad taste
8	B. G. Moore	Drilled	Slope	Mfs	6	55	20	25	----	52	Domestic	Some iron
9	Lee Johnson	Drilled	Flat	Mfs	6	85	15	11	1954	---	Domestic and stock	Some iron
10	Thomas W. Hansell	Drilled	Slope	Mfs	6	65	12	--	----	20	Domestic	Some iron
11	H. A. Lindsey	Drilled	Slope	Mfs	8	60	12	Will flow	----	---	Domestic	Some iron
12	Lewis H. Corbin	Drilled	Slope	Mfs	6	80	63	--	----	---	Domestic	
13	T. E. Stepp	Drilled	Hillside	Mls (?)	6	50	--	--	----	---	Domestic	Some iron
14	Hill Yarborough	Drilled	Slope	Da	6	48	20	5	1950	15	Domestic	
15	W. H. Maxey	Drilled	Slope	Da-Mls	6	96	--	--	----	---	Domestic and stock	
16	E. E. Perry	Drilled	Slope	Mfp	6	48	18	6	1961	12	Domestic and stock	Some iron
17	J. H. Ponder	Drilled	Slope	Mfs	6	102	70	55	1946	7	Domestic and stock	
18	Norman Dew	Drilled	Slope	Mfs	6	50	21	15	1959	10	Domestic	
19	J. H. Hawkins	Drilled	Slope	Mfs	6	58	24	20	1958	10	Domestic	
20	Norman Broom	Drilled	Slope	Mfs	6	87	22.5	8	1944	---	Domestic	
21	E. All	Drilled	Slope	Mfs	6	73	60	15	1960	---	Domestic	Some iron

Table 6 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
4KK 22	G. A. Mills	Drilled	Slope	Mfs	6	75	34	50	1961	18	Domestic	
23	A. P. Mills	Drilled	Slope	Mfs	6	93	30	17	1961	20	Domestic and stock	Some iron
24	B. A. Duke	Drilled	Slope	Mfs	6	51.5	20	25	1956	16	Domestic	Some iron
25	M. A. Green	Drilled	Slope	Mfs	6	80	60	--	----	---	Domestic	
26	S. L. Miller	Drilled	Slope	Mfs	6	165	--	--	----	---	Stock	Some iron
27	Horace Pierce	Drilled	Slope	Mfs	6	82.5	19	21	1953	10	Domestic and stock	
28	Joe Touchstone	Drilled	Slope	Mfs	6	92	--	--	----	---	Domestic	
29	James Pasley	Drilled	Slope	Mfs	6	45	--	--	----	10	Domestic	
30	Mrs. Clarence Willis	Drilled	Slope	Mfp or Mfs	6	47.5	25	18	1959	---	Domestic and stock	
31	E. D. Payton	Drilled	Slope	Mfp or Mfs	6	50	9	15	1955	---	Domestic	Not sufficient yield for year-round use
32	Dewey Ellison	Drilled	Slope	Mfs	6	52.5	9	12	1957	---	Domestic	
33	Frank S. Everett	Drilled	Slope	Mfs	6	50.5	21	10	1952	---	Domestic	Some iron
34	Floyd County Board of Education	Drilled	Flat	Mfs	8	344	100	150	----	21	None	High iron, lime
5KK1	Hugh Everett	Drilled	Slope	Mfs	6	72	21	12	1961	---	Domestic	
2	J. W. Miller	Drilled	Slope	Mfs	6	85	18	35	1954	---	Domestic and stock	Some iron
3	D. W. White	Drilled	Slope	Mfs	6	82	21	16	1961	---	Domestic	Some iron
4	Merl V. Williams	Drilled	Slope	Mfs	6	123	--	40	1960	---	Domestic and stock	Some iron
5	D. W. White	Drilled	Slope	Mfs	6	80	63	--	----	---	Domestic and stock	Some iron
6	T. W. Evans	Drilled	Slope	Ꞓcsl	6	75	42	--	----	---	Domestic	
7	Henry Dobinson	Drilled	Hillside	Mfs	6	108	16	11.44	1961	---	Domestic	Some iron
8	Eads Estate	Drilled	Slope	Mfs or possibly Ml	6	113	42	--	----	---	None	Some iron
9	Eads Estate	Drilled	Slope	Mfs or Ml	6	110	30	--	----	---	Domestic	
10	R. H. Terry	Drilled	Slope	Mfs	6	65	42	--	----	---	Domestic	Some iron
11	Benny T. Reece	Drilled	Slope	Mls	6	55	21	14.19	1961	---	Domestic	Some iron
12	C. A. Bird	Drilled	Flat	Mfs	6	85.5	--	--	----	8	Domestic	
13	J. C. Young	Drilled	Flat	Mfs	6	53	20.5	--	----	---	Domestic	Some iron
14	C. E. Griffin	Drilled	Flat	Mfs	6	60	38	15	1961	20	Domestic and stock	Some iron
15	Horton Estate	Drilled	Flat	Ccsl	6	85	85	--	----	---	Domestic and stock	

Table 6 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
5KK 16	Henry Ratliff	Drilled	Slope	Ꞓc or Ꞓcl	6	95	30	--	----	18	Domestic	
17	S. J. Whatley	Drilled	Slope	Ꞓcs	4	60	20	5.80	1961	---	Domestic	Flows during winter
18	M. K. Babb	Drilled	Flat	Ꞓc	6	85	12	5	1956	11	Watering grass	
19	Homer N. Smith	Drilled	Slope	Ꞓc	6	52	52	15	1961	---	Domestic and stock	
20	C. L. Autry	Drilled	Slope	Ꞓc	6	77	77	20	1961	---	Domestic and stock	
21	Mrs. Annie Lee Nix	Drilled	Slope	Ꞓc	6	92	92	--	----	---	Domestic and stock	
2JJ1	Q. M. Carroll	Drilled	Hillside	Ꞓcsl	6	225	70	--	----	---	Domestic	
4LL1	Hugh Treadaway	Drilled	Hillside	Mfs	6	60	60	48	1954	---	Domestic and stock	
5LL1	Rome Hatchery	Drilled	Slope	--	6	146	--	14	1960	---	Domestic and stock	
2	Rome Hatchery	Drilled	Slope	--	6	46	21	10.45	1961	---	Domestic and stock	
3	Weldon Touchstone	Drilled	Slope	--	6	92	20	20	1961	---	Domestic and stock	

Table 7.-- Record of wells in Polk County, Georgia.

Geologic symbol: Mfs, Floyd Shale; Mfp, Fort Payne Chert; Ors, sandstone and conglomerate in Rockmart Slate; Or, Rockmart Slate; On, Newala Limestone; OCk, Knox Group; Cc, Conasauga Formation; Tu, Talladega Slate, undifferentiated.

Well No.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
2FF1	Herman Hill	Drilled	Slope	OЄk	6	135.0	135.0	--	----	--	Domestic and stock	
2	Jud Bozier	Drilled	Slope	OЄk	6	206.5	149	111	1948	--	Domestic	
3	Max Harden	Drilled	Slope	On	6	95	95	30	----	--	Domestic and stock	
4	Ed Williams	Drilled	Slope	On	6	93	--	58	----	--	Domestic	
5	Emmett Laurens	Drilled	Slope	On	6	276	60	dry	----	--	None	
6	Paul Watson	Drilled	Hilltop	On	6	200	185	30	----	10	Domestic	
7	Andy Donaldson	Drilled	Hillside	On	6	93	93	40	----	70	Domestic	
3FF1	I. W. Pruitt	Drilled	Slope	On-OЄk	6	155	--	--	----	4	Domestic	
2	R. C. Pruitt	Drilled	Slope	OЄk	6	101	--	50	----	15	Domestic	
3	W. W. Corn	Drilled	Slope	OЄk*	6	70	70	35	----	10	Domestic and stock	QW analysis
4	W. W. Corn	Drilled	Slope	OЄk	6	69	69	20	----	--	Domestic and stock	
5	Louis Hajosy	Drilled	Hillside	On	6	180	160	60	----	8	Domestic	
6	C. & S. Breeding Farm	Drilled	Hillside	On	6	85	85	55	----	15	Domestic and stock	
7	W. J. Knight	Drilled	Hillside	On	6	52	52	20	----	--	Domestic	
8	H. E. Wood	Drilled	Slope	On	6	107	89	30	----	--	Domestic	
9	W. S. Watson	Drilled	Slope	On	6	75	60	37	----	10	Domestic and stock	
10	Paul Rainey	Drilled	Hilltop	On	6	88	65	--	----	10	Domestic and stock	
11	H. D. Pope	Drilled	Hillside	OЄk	6	81	81	30	----	--	Domestic	
12	Lumus Dingler	Drilled	Hillside	Or	6	100	40	18	----	10	Domestic and stock	
13	E. M. Head	Drilled	Slope	On	6	119	--	55	----	--	Domestic	QW analysis
14	J. I. Casey	Drilled	Slope	On	6	265	--	32	----	--	Domestic and stock	
15	Jewell Hulsey	Drilled	Hillside	OЄk	6	487	85	45	----	15	Domestic and stock	
16	Thomas Wray	Drilled	Hillside	Or	6	78	12	13	----	18	Stock	Sulfur
17	T. D. Wray	Drilled	Slope	On	6	52	30	20	----	10	Domestic and stock	
18	David Powell	Drilled	Flat	Or	6	55	55	11	----	18	Domestic and stock	
19	Arthur Garmon	Drilled	Slope	Or	6	90	20	25	----	10	Domestic and stock	
20	Edward Dyer	Drilled	Slope	Or	6	92	21	15	----	4	Domestic and stock	
21	Homer Hackney	Drilled	Flat	Or	6	55	21	16	----	18	Domestic and stock	Some iron
22	J. C. Covey	Drilled	Slope	Or	6	56	--	10	----	10	Domestic	Some iron
23	R. D. Byron	Drilled	Slope	Or	6	60	50	15	----	--	Domestic and stock	

Table 7 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
3FF24	W. F. Knight	Drilled	Slope	Or	6	55		15	----	30	Domestic	Some iron
25	W. D. Jarrell	Drilled	Slope	On	6	40	16	15	----	25	Domestic	Some iron - QW analysis
26	O. L. Culp	Drilled	Slope	Or	6	103	36	22	----	--	Domestic and stock	Some iron
27	G. B. Lee, Jr.	Drilled	Slope	On	6	391	30	--	----	--	Domestic and stock	
28	C. L. Wright	Drilled	Slope	Or	6	161	--	81	----	--	Domestic	
29	Preacher Howard	Drilled	Slope	Or	6	63	--	4.66	1948	--	Domestic	
30	Lovey Davis	Drilled	Slope	Or	6	70	--	15	1948	--	Domestic	
31	Arthur Blyther	Drilled	Flat	Or	6	26.5	--	18	1948	--	Domestic	
32	W. C. Holbrook	Drilled	Slope	On	6	90	--	18.7	1948	--	Domestic	
33	John M. Forrister	Drilled	Slope	On	6	113	10	25	----	--	Domestic	
34	W. M. Holbrook	Drilled	Flat	Or	6	39	8	3	----	--	Domestic	Some iron
35	Wiley Casey	Drilled	Slope	On	6	97	87	20	----	75	Domestic and stock	
36	Tona Sawyer	Drilled	Slope	On	6	430	40	8	----	11	Domestic and stock	Some iron
37	Homer J. Carnes	Drilled	Slope	Or	6	114	104	--	----	--	Domestic and stock	Some iron
38	Lester Commor	Drilled	Flat	O€k	6	130	--	3.62	1948	--	Domestic	
39	H. A. Von Husyer	Drilled	Slope	Or	6	54	34	24	----	15	Domestic	
40	John Brach	Drilled	Slope	On	6	100	40	--	----	3	Domestic	
41	Louis S. Hajosy	Drilled	Flat	On	6	70	40	--	----	--	Domestic and stock	
4FF1	William Whitfield	Drilled	Slope	Or	6	198	20	--	----	11	Domestic	
2	J. J. Lassiter	Drilled	Slope	O€k	6	200	13	--	----	80	Cannery	
3	Amos Hudson, Jr.	Drilled	Slope	On	6	410	52	45	----	7	Domestic	
4	Scott Dollar	Drilled	Hillside	Tu	6	128	28	30	----	10	Domestic and stock	Some iron
5	Wallace Simpson	Drilled	Flat-valley	On	6	115	6	--	----	--	Domestic	
6	James Keil	Drilled	Slope	Or	6	78	78	37	----	15	Domestic	
7	Joel Atkins	Drilled	Slope	O€k	6	90	40	50	----	--	Domestic	
8	M. W. Lee	Drilled	Slope	Or	6	196	100+	--	----	30	Domestic and stock	
9	E. M. Stewart	Drilled	Slope	On+Or at top	6	212	--	--	----	10	Domestic and stock	
10	Jack Sharp	Drilled	Slope	O€k	6	140	30	40	----	10	Domestic and stock	
11	Warren Gifford	Drilled	Slope	On	6	78	--	61	----	--	Domestic	

Table 7 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
4FF 12	Robert Grogan	Drilled	Flat	On	6	250	50	--	----	1/2	Domestic	
13	Polk County	Drilled	Flat	On	8	225	200	40	----	11	School	
14	Nat Campbell	Drilled	Slope	On	6	65	40	25.25	1948	--	Domestic	
15	Wesley Atkins	Drilled	Slope	Or	6	165	20	15	----	5	Domestic	
16	Billy Campbell	Drilled	Slope	On	6	240	59	58	1952	5	Domestic and stock	Some iron
17	Mrs. Marco Davis	Drilled	Foot of hill	O€k	6	91.8	38	--	----	6	Domestic and stock	Some iron
18	R. L. Grogan	Drilled	Slope	On	6	198	198	60	----	8	Domestic	
19	Tom Mullen	Drilled	Slope	O€k	6	52	42	20	----	--	Domestic and stock	
20	L. O. Lawrence	Drilled	Slope	O€k	6	74	74	39	----	20	Domestic and stock	
21	Gammage Const. Co.	Drilled	Slope	On	6	160	--	5.19	1948	--	Domestic	
22	Doyle Baldwin	Drilled	Slope	On	6	98.5	33	15	----	30	Domestic	
23	Seaboard RR	Drilled	Slope	On	6	23.2	--	11.82	1948	--	Domestic	
24	Walt Chandler	Drilled	Hillside	Or	6	126	126	--	----	10	Domestic and stock	
25	Charles Wood	Drilled	Flat	On	6	150	150	28	----	--	Domestic and stock	
26	C. A. McBurnett	Dug	Foot of hill	Tu	120	8	8	2	1962	--	Stock	
27	Cedartown Rod and Gun Club	Drilled	Hillside	Tu	6	125	18	8	1962	3 1/2	Domestic	
28	Don Norris	Drilled	Slope	O€k-On	6	100	62	--	----	60	Domestic	
5FF1	Oliver Wood	Dug	Hillside	Tu	29	30	--	8	----	--	Domestic	Some iron
2	Lowell C. Hiatt	Dug	Hillside	Tu	48	51	--	40	----	--	Domestic	Some iron
3	Hoke Thompson	Dug	Hillside	Tu	36	23	--	18	----	--	Domestic	
4	F. O. Barrow	Drilled	Slope	O€k	6	135	115	80	----	5	Domestic and stock	
5	Mrs. John I. Davis	Drilled	Slope	On	6	312	--	--	----	--	Domestic and stock	Some iron
6	H. L. Brumbelow	Drilled	Slope	O€k	6	292	83	80	----	10	Domestic and stock	
7	Bill Miller	Drilled	Slope	O€k	6	107	107	95	----	7	Domestic and stock	
8	F. W. Waters	Drilled	Slope	On	6	67	57	20	----	10	Domestic and stock	
9	Walt Chandler	Drilled	Hillside	Ors	6	150	14	30	----	10	Domestic and stock	Some iron
10	J. W. Stegall	Drilled	Hillside	Ors	6	44	15	23.13	1948	2	Domestic and stock	
11	W. C. Jacobs	Drilled	Slope	Or	6	80	25	50	----	--	Domestic	
12	J. R. Hutchison	Drilled	Slope	Or	6	106	17	--	----	--	Domestic and stock	

Table 7 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
5FF13	Wm. Paul Dumas and Wayne Yates	Drilled	Slope	Ors	6	126	100	15	----	1 1/2	Domestic	
14	Ralph O. Jackson, Jr.	Drilled	Hillside	Or	6	100	100	70	----	--	Domestic	
15	Ralph O. Jackson, Jr.	Drilled	Slope	dolomite? and chert?	6	186	80	80	----	--	Domestic and stock	
16	Fred White	Dug	Slope	Tu	48	57	--	57.5	1964	--	Domestic	
17	Robert Forsyth	Drilled	Hillside	On	6	376	60	60	----	10	Domestic and stock	
18	Robert Forsyth	Drilled	Hillside	Or(?)	6	196	196	50	----	10	Domestic and stock	
19	Walter L. Baines	Drilled	Hillside	Ors	6	107	65	67	----	10	Domestic	
6FF1	Dorsey Jones	Drilled	Hilltop	Tu	6	130	95	90	----	6	Domestic	
2GG1	J. P. Shaw	Drilled	Slope	O€k residuum	6	60	60	30	----	--	Domestic and stock	
2	J. P. Shaw	Drilled	Slope	O€k	6	162	162	50	----	30	Domestic and stock	
3	Jane Hicks and Stovall Trawick	Drilled	Flat-valley	Mfs	6	130	130	75	----	--	Domestic and stock	Some iron
4	C. N. Dougherty	Drilled	Flat-valley	Mfs	6	130	130	30	----	10	Domestic	Some iron
3GG1	J. D. Beck	Drilled	Flat	€c	6	55	55	14	----	28	Domestic and stock	
2	T. A. Willingham	Drilled	Flat	O€k	6	101	100	61	----	--	Domestic and stock	
3	Luther Dempsey	Drilled	Flat	O€k	6	49	49	27	----	--	Domestic and stock	
4	George Rice	Drilled	Slope	O€k	6	274	65	--	----	--	Domestic	
5	Robert Campbell	Drilled	Slope	O€k	6	200	--	49.08	1948	--	None	
6	Polk County	Drilled	Slope	O€k-On	6	205	--	100	----	12	School	
7	Ben Parrish	Drilled	Slope	O€k	6	183	183	150	----	12	Domestic	Some iron
8	J. A. Kilpatrick	Drilled	Slope	O€k	6	57	52	15	----	--	None	
9	M. W. Youngblood	Drilled	Slope	O€k	6	72	--	--	----	--	Domestic and stock	Some iron
10	Mrs. Lola Wingate	Drilled	Slope	O€k	6	57	57	20	----	10	Domestic and stock	Some iron
11	Glen Carter	Drilled	Slope	O€k	6	80	70	--	----	20	Domestic	
12	Mrs. C. V. Shost	Drilled	Slope	O€k	6	218	84	---	----	--	Domestic	
13	John Redding	Drilled	Slope	O€k	6	137	60	76	----	60	Domestic	
14	Mrs. Christine Smith	Drilled	Slope	O€k	6	182	182	150	----	--	Domestic and stock	Some iron
15	J. B. Green	Drilled	Flat	On	6	53	15	--	----	10	Domestic	
16	N.W. Sorrells	Drilled	Slope	O€k	6	145	145	--	----	--	Domestic	

Table 7 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
3GG 17	Clarence Drumond	Drilled	Slope	O€k	6	82	82	--	----	7	Domestic and stock	
18	Joe M. Collier	Drilled	Slope	O€k	6	85	--	--	----	--	Domestic	
19	Avery Gossett	Drilled	Slope	O€k	6	125	--	--	----	6	Domestic	Some iron
20	S. C. Madden	Drilled	Hilltop	O€k	6	93	93	--	----	18	Domestic and stock	
21	H. E. Odom	Drilled	Slope	O€k	6	66	--	30	----	--	Domestic	
22	Ted Smith	Drilled	Slope	O€k	6	110	98	--	----	25	Domestic	
23	W. H. Dempsey	Drilled	Slope	O€k	6	132	--	--	----	--	Domestic and stock	Some iron
24	T. W. Thompson	Drilled	Slope	On	6	84	57	32	----	15	Domestic	
25	Fred Sprayberry	Drilled	Slope	On	6	80	25	6	----	--	Domestic	
26	W. R. Robinson	Drilled	Slope	O€k	6	100	100	--	----	10	Domestic and stock	
27	W. R. Robinson	Drilled	Slope	O€k	6	100	100	35	----	10	Stock	
28	Robert H. Witcher	Drilled	Slope	O€k	6	100	100	50	----	10	Domestic and stock	
29	James Strickland	Drilled	Slope	O€k	6	217	175	100	----	10	Domestic and stock	Some iron
30	M. Mannus	Drilled	Hillside	O€k	6	134	--	--	----	--	Domestic	
31	James F. Green	Drilled	Slope	O€k	6	169	169	109	----	7	Domestic and stock	
32	Mrs. G. C. Green	Drilled	Slope	O€k	6	158	158	136	----	--	Domestic and stock	
33	H. W. Bedford	Drilled	Slope	O€k	6	87	60	26	----	10	Domestic	
34	Paul Heard	Drilled	Slope	O€k	6	215	207	--	----	10	Domestic	
35	B. W. Edwards	Drilled	Slope	On	6	440	70	40	----	12	Domestic and stock	
36	M. Teal	Drilled	Flat	On	6	32	20	--	----	10	Domestic	
37	T. F. Atkins	Drilled	Slope	O€k	6	62	--	22.12	1948	--	Domestic	
38	C. W. Zuker	Drilled	Slope	O€k	6	100	60	--	----	--	Domestic	
39	Napco Chemical Co.	Drilled	Flat	On	10	73	42	20	----	1500	Industrial	
40	Robert Campbell	Dug	Slope	O€k	48	40	--	--	----	--		
4GG1	Georgia Forestry Comm.	Drilled	Slope	O€k	6	100.5	90	9	----	--	Domestic	Some iron
2	H. M. Isbell	Drilled	Slope	O€k	6	167	17	--	----	--	Domestic	
3	Porter Grimes	Drilled	Flat	O€k	6	128	128	90	----	--	Domestic and stock	
4	Guy Rutland	Drilled	Hillside	O€k	6	99	9	45	----	10	Bath	Some iron
5	Betty Stucher	Drilled	Flat	O€k	6	89	89	--	----	--	Domestic	

Table 7 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
4GG 6	Jimmie O. Camp	Drilled	Hillside	O€k	6	206.5	206.5	--	----	2	Domestic	
7	Glenn Ledford	Drilled	Hillside	O€k	6	200	200	150	----	3	Domestic	
8	J. W. Wills	Drilled	Slope	€c	6	68	61	20	----	20	Domestic	
9	Henry Godwin, Sr.	Drilled	Slope	O€k	6	67.3	67	55.93	1948	--	Domestic	
10	R. R. Morgan	Drilled	Flat	€c	6	111	41	25	----	3	Domestic	
11	Polk County	Drilled	Flat	€c	6	208	120	70	----	13	School	
12	M. C. Stringer	Drilled	Slope	€c	6	47.5	47.5	12.5	----	--	Domestic	
13	Harper Home Farm	Drilled	Slope	€c	6	104	90	90.46	1948	--	Domestic and stock	
14	Unknown	Drilled	Hillside	€c	6	112	112	70	----	--	Domestic	
15	Polk County	Drilled	Slope	O€k	6	185	--	60	----	10	School	
16	Eugene Drumond	Drilled	Slope	O€k	6	71	61	31	----	16	Domestic	
17	J. W. Wood	Drilled	Hillside	O€k	6	98.5	88.5	68.5	----	--	Domestic	
18	Oscar Welchell	Drilled	Slope	O€k	6	52	52	40	----	--	Domestic and stock	
19	Mrs. Chapple Juice	Drilled	Slope	O€k	6	42	--	32.8	1945	--	Domestic	
20	Stanley Arnold	Drilled	Slope	O€k	6	107	--	--	----	--	Domestic	
21	Hugh Deems	Drilled	Slope	€c	6	216	21	66	----	10	Domestic and stock	
22	J. E. Ishom	Drilled	Slope	O€k	6	120	120	--	----	10	Domestic and stock	
23	W. F. Davis	Drilled	Slope	O€k	6	127	127	77	----	10	Domestic and stock	Some iron
24	R. F. Casey	Drilled	Slope	O€k	6	86	76	--	----	14	Domestic	
25	Mrs. Noble Holland	Drilled	Slope	€c	6	96	--	40	----	10	Domestic and stock	
26	H. B. Simpson	Drilled	Slope	€c	6	103	87	33	----	15	Domestic and stock	
27	V. O. Stewart	Drilled	Slope	€c	6	101	50	--	----	--	Domestic and stock	
28	H. W. Trawick	Drilled	Hillside	O€k	6	360	180	--	----	20	Domestic	Salty taste
29	S. W. Trawick	Drilled	Hillside	O€k	6	85	--	--	----	--	Domestic and stock	
30	W. G. Hice	Drilled	Slope	O€k	6	158	155	60	----	--	Domestic and stock	Some iron
31	B. F. Drummond	Drilled	Slope	O€k	6	280	280	100	----	8	Domestic	
32	Mrs. E. T. Faires	Drilled	Hillside	O€k	6	195	195	40	----	6	Domestic	
33	FHA	Drilled	Hillside	O€k	6	251	151	70	----	--	None	
34	T. V. Pilgrim, Sr.	Drilled	Slope	O€k	6	90	75	--	----	--	Domestic	

Table 7 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
4GG 35	Herbert Dollar	Drilled	Slope	O€k	6	128	128	60	----	--	Domestic and stock	
36	John A. Austin	Drilled	Slope	O€k	6	128	130	110	----	5	Domestic and stock	
37	Rupert W. Herndon	Drilled	Slope	O€k	6	126	126	56	----	0	Domestic and stock	Some iron
38	Billy Austin	Drilled	Slope	O€k	6	270	190	172	----	10	Domestic	
39	M. M. Casey	Drilled	Slope	O€k	6	81	81	25	----	25	Domestic and stock	
40	R. E. Blair	Drilled	Slope	O€k	6	104	104	59	----	10	Domestic and stock	
41	J. W. Long	Drilled	Slope	O€k	6	135	--	60	----	--	Domestic and stock	
42	Mrs. Dora Edwards	Drilled	Hillside	O€k	6	165	100	--	----	--	Domestic	
43	W. B. Early	Drilled	Slope	O€k	6	153	133	138	----	10	Domestic	
44	W. H. Blanchard	Drilled	Hillside	O€k	6	224.5	100	--	----	--	Domestic	
45	J. E. Wesson	Drilled	Hillside	O€k	6	160	--	--	----	--	Domestic	
46	Harry Lumpkin	Drilled	Hillside	O€k	6	167	167	--	----	--	Domestic and stock	
47	J. B. Willingham	Drilled	Flat	O€k	6	120	114	88	----	12	Domestic	
48	Luther Boling	Drilled	Flat	O€k	6	50	42	22	----	10	Domestic	
49	Keith L. Lawllass	Drilled	Slope	O€k	6	115	115	40	----	10	Domestic and stock	
50	J. S. Holland	Drilled	Slope	€c	6	99	70	54	----	15	Domestic	
51	Dil Barnett	Drilled	Slope	€c	6	147	35	87	----	20	Domestic	
52	Sammy King	Drilled	Slope	O€k	6	110	110	18	----	--	Domestic and stock	
53	Calvin Bell	Drilled	Slope	O€k	6	140	140	90	----	12	Domestic and stock	
54	A. C. Garrett, Jr.	Drilled	Slope	O€k	6	122.5	117.5	40	----	6	Domestic and stock	
55	Rayford Deemes	Drilled	Slope	O€k	6	160	47	110	----	30	Domestic and stock	
56	Jim Cook	Drilled	Hillside	O€k	6	155	155	--	----	20	Domestic and stock	
57	James F. Crawford	Drilled	Hillside	O€k	6	80	80	40	----	5	Domestic and stock	
58	Mrs. W. L. Wilkerson	Drilled	Hillside	O€k	6	267	165	167	----	7	Domestic and stock	
59	Billy Wilkerson	Drilled	Hillside	O€k	6	90	78	45	----	10	Domestic and stock	
60	Charles Blair	Drilled	Hillside	O€k	6	91	91	--	----	10	Domestic and stock	
61	R. F. Spanger	Drilled	Slope	O€k	6	90	00	67.4	1948	35	Domestic and stock	
62	W. M. Zuker	Drilled	Slope	€c	6	83	83	41	----	--	Domestic and stock	
63	M. Lindsey	Drilled	Flat	€c	6	83	--	54.77	1948	--	Domestic and stock	

Table 7 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
4GG 64	Roy Adams	Drilled	Hillside	O€k	6	83	22	15	----	30	Domestic and stock	
65	Uxbridge Division of Indian Head Mills	Drilled	Slope	On	10	190	80	60	----	650	Industrial	
5GG1	Bob Harrison	Drilled	Slope	O€k	6	130	130	60	----	8	Domestic	
2	E. C. Johnson	Drilled	Slope	O€k	6	118.5	118.5	36	----	9	Domestic	
3	Jack Campbell	Drilled	Slope	O€k	6	121	121	81	----	5	Domestic	
4	Elmo Pepper	Drilled	Slope	O€k	6	114	112	75	----	--	Domestic	
5	R. K. Brembelow	Drilled	Slope	O€k	6	146.5	146	46	----	--	Domestic	
6	C. B. Nettler	Drilled	Hillside	On or top of O€k	6	105	105	65	----	--	Domestic	
7	Belle View Church	Dug	Slope	O€k residuum	48	17	--	19.0	1948	--	Church	
8	Paul McCown	Drilled	Slope	O€k	6	130	100	65	----	--	Domestic	
9	Gilbert Campbell	Drilled	Hillside	O€k	6	229.5	68	99	----	--	Domestic and stock	
10	O. L. Smith	Drilled	Slope	On	6	77	72	--	----	10	Domestic and stock	
11	Alvis Miller, Jr.	Drilled	Slope	O€k	6	137	75	54	----	10	Domestic	
12	B. E. Golden	Drilled	Slope	On	6	82	70	42	----	8	Domestic and stock	
13	G. A. Fuchs	Drilled	Slope	On	6	54	7	13	----	--	Domestic and stock	
14	E. M. Herring	Drilled	Slope	On	6	151.5	14	48	----	--	Domestic and stock	
15	Mrs. May Bennett	Drilled	Slope	On	6	129	30	--	----	--	None	
16	A. F. Jackson	Drilled	Slope	On	6	359	34	20	----	20	Domestic and stock	
17	Mrs. Horace Williams	Drilled	Slope	On	6	103	35	43	----	10	Domestic and stock	
18	Charley Fanin	Drilled	Slope	On	6	150	75	86	----	4	Domestic	
19	Dock Mootes	Drilled	Slope	On	6	60	46	30	----	10	Domestic and stock	
20	J. A. Abernathy	Drilled	Hilltop	On	6	186	38	45	----	5	Domestic	
21	R. H. Bond	Drilled	Slope	O€k	6	290	40	40.96	1946	--	Stock	
22	Paul Morgan	Drilled	Slope	On	6	109.5	54	58	----	6	Domestic and stock	Some iron
23	I. Gentry	Drilled	Slope	On	6	76	60	55	----	4	Domestic	
24	Roy Hughes	Drilled	Slope	On	6	83	60	25	----	10	Domestic	
25	S. J. Noland	Drilled	Slope	On	6	219	16	18	----	--	Domestic	
26	Cleo Brown	Drilled	Hillside	Or	6	143	139	100	----	10	Domestic and stock	QW analysis

Table 7 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
5GG 27	L. W. Spinks	Drilled	Slope	Or	6	172	172	75	----	4	Domestic	
28	H. I. Brock	Drilled	Slope	On	6	105	40	45	----	--	Domestic	
29	L. C. Carlton	Drilled	Slope	On	6	444	44	44	----	16	Domestic and stock	
30	J. R. Terry	Drilled	Slope	On	6	308	208	100	----	20	Domestic and stock	
31	J. H. Fincher	Drilled	Slope	On	6	90	34	54	----	10	Domestic	
32	James Harvey	Drilled	Slope	On	6	165	162	75	----	5	Domestic and stock	
33	Roy Forsyth	Drilled	Slope	On	6	94	94	--	----	--	Domestic	
34	Bill Dover	Drilled	Slope	On	6	25	--	20.6	1948	--	Domestic	
35	Rube Engle	Drilled	Slope	On	6	249	100	99	----	--	Domestic	
36	Albert W. Ingle	Drilled	Hillside	On	6	106	17	13	----	8	Domestic and stock	
37	Southern Railway	Drilled	Slope	O€k	6	89	--	--	----	--	Domestic	
38	J. W. Pinkard	Drilled	Hillside	O€k	6	83	81	33	----	20	Domestic and stock	
39	John Davis	Drilled	Hillside	O€k	6	101	21	40	----	--	Domestic and stock	
40	Jimmy Strange	Drilled	Hillside	On	6	123	123	43	----	30	Domestic	
41	T. K. Davitte	Drilled	Slope	On	6	64	40	20	----	10	Domestic and stock	
42	D. H. Lewis	Drilled	Slope	On	6	48	30	20	----	10	Domestic	
43	W. C. Deaton	Drilled	Hillside	On	6	117	67	50	----	10	Domestic and stock	
44	Will M. White	Drilled	Slope	On	6	120	44	44	----	20+	Domestic and stock	
45	R. B. Arp, Sr.	Drilled	Slope	On	6	72	64	30	----	15	Domestic and stock	
46	George Baine	Drilled	Slope	On	6	106	40	44	----	6	Domestic	
47	James L. Lowell	Drilled	Slope	O€k	6	450	38	44	----	5	Domestic and stock	
48	John H. Morgan	Drilled	Slope	O€k	6	67	67	--	----	12	Domestic	
49	Mrs. W. M. Jones	Drilled	Flat	On	6	85	77	--	----	10±	Domestic and stock	
50	Harry Wright	Drilled	Slope	O€k	6	120	100+	--	----	10	Domestic	
51	Calvin Fredick	Drilled	Slope	O€k	6	241	80	61	----	3	Domestic and stock	
52	Tom Fitzpatrick	Drilled	Slope	O€k	6	134	134	--	----	5	Domestic and stock	
53	Raymond Mull	Drilled	Slope	O€k	6	90	90	70	----	5	Domestic and stock	
54	T. E. Whiteside	Drilled	Slope	O€k	6	275	115	135	----	--	Domestic	
55	H. B. Clark	Drilled	Slope	O€k	6	34	--	--	----	--	None	

Table 7 (cont.)

Well no.	Owner	Type of well	Topography	Geologic symbol of aquifer	Diameter of well (inches)	Depth (feet)	Cased to (feet)	Water-level below land surface	Date measured	Yield (gpm)	Use	Remarks
5GG 56	Charles Dansby	Drilled	Slope	OЄk	6	142	115	--	-----	8	Domestic	
57	Fred Pinkard	Drilled	Slope	OЄk	6	240	210	--	----	5	Domestic and stock	
58	Tyrus Jones	Drilled	Slope	OЄk	6	136	136	90	----	30	Domestic	
59	P. R. Garnett	Drilled	Slope	OЄk	6	142	142	26	----	3	Domestic and stock	
60	Cecil Kite	Drilled	Slope	OЄk	6	186	186	126	----	--	Domestic and stock	
61	Clyde Tillery	Dug	Flat	OЄk	36	22	--	10	----	--	Domestic and stock	
62	Howard E. Davis	Drilled	Flat	OЄk residuum	6	135	--	--	----	15	Domestic	
6GG1	D. E. Waldrop	Drilled	Hillside	On	6	152.5	152.5	94	----	6	Domestic	
2	Mrs. J. W. Waldrop Estate	Drilled	Slope	OЄk	6	106	106	56	----	7	Domestic	Some iron
3	Ivey Waits	Drilled	Hilltop	Mfp	6	76	76	--	----	--	Domestic and stock	
4	C. S. Smith	Drilled	Slope	Mfp	6	125	80	105	----	10	Domestic	
5	C. T. Cagle	Drilled	Slope	On	6	186	120	--	----	10	Domestic and stock	
6	Ivey Evans	Drilled	Slope	On	6	250	--	177	----	--	Domestic and stock	