DESCRIPTION OF THE MONTEVALLO AND COLUMBIANA QUADRANGLES

By Charles Butts

INTRODUCTION
LOCATION AND EXTENT

As shown by the key map (fig. 1) the Montevallo and Columbiana quadrangles are in the north-central part of Alabama, mainly in Shelby, Bibb, and Chilton Counties. The northwest corner of the Montevallo quadrangle includes a small area of Jefferson County, and the eastern part of the south of New England is divisible into four parts called provinces. These are, from southeast to northwest, the Piedmont province, the Blue Ridge province, the Valley and Ridge province, and the Appalachian Plateaus. West of the Appalachian Plateaus are the Interior Low Plateaus, which are included in the Interior Plains by the Association of American Geographers but which in the opinion of some, including the writer, should be regarded as part of the Appalachian Highlands.

The geographic division of the United States, as a whole, is divided into four parts called provinces. These are, from southeast to northwest, the Piedmont province, the Blue Ridge province, the Valley and Ridge province, and the Appalachian Plateaus. West of the Appalachian Plateaus are the Interior Low Plateaus, which are included in the Interior Plains by the Association of American Geographers but which in the opinion of some, including the writer, should be regarded as part of the Appalachian Highlands.

Talladega Counties. The quadrangles are bounded by parallel north and south lines 8°10' and 8°17' and meridians 86°02' and 87°. Each quadrangle covers one-sixteenth of a "square degree" and has an area of 250 square miles.

GENERAL RELATIONS
Northern Alabama is in the southern part of the Appalachian Highlands. This physiographic division of the United States extends from the Atlantic Plain on the east to the Blue Ridge province in Tennessee, lying midway between Knoxville and Nashville, is a broken escarpment 800 to 1,000 feet high, separating the Cumberland Plateau from the Highland Plains. This boundary is extended northeastward through eastern Kentucky and central Ohio to the vicinity of Cleveland, although it is not sharply defined in those States.

The Piedmont province is a rolling upland 1,100 feet above sea level at the foot of the Blue Ridge and 500 feet or less along the "fall line." Its generally flat surface has been deeply trenched by the streams that flow across it. It is underlain by very ancient and eroded crystalline rocks, both igneous and metamorphic. A small area in the southeast corner of the Columbiana quadrangle lies in the Piedmont province.

The Blue Ridge province is narrow at its north end in Pennsylvania but more than 60 miles wide in North Carolina. It is a rugged region of hills and ridges and deep, narrow valleys. The altitude of the higher summits in Virginia is 5,000 to 5,700 feet above sea level, and in western North Carolina Mount Mitchell, 6,711 feet high, is the highest point east of Mississippi River. Throughout its extent this province stands up conspicuously above the adjoining province, from each of which it is separated by a steep, broken, rugged front from 1,000 to 3,000 feet high. The rocks of this province consist chiefly folded quartzite, slate, schist, gneiss, granite, and gneissites.

GENERAL FEATURES

The Valley and Ridge province, in which the Montevallo and Columbiana quadrangles are mainly situated, is a belt 50 to 80 miles wide, extending from Canada into Alabama, which is the width of Virginia. The Blue Ridge province on the east and the Appalachian Plateaus on the west. Near Big Stone Gap, Va., the crest of the Big Black Mountains is 5,000 feet above the valley on its northwest side, and in northern Tennessee Holston Mountain, near the northwest front of the Appalachian Plateaus, rises nearly 3,000 feet above the valley on its southeast side.

In other places, as in the Birmingham district, the valley is but slightly disturbed. The rocks of this province are not crystalline, like those of the Piedmont and Blue Ridge provinces, but are all sediments. They include limestone, dolomite, conglomerate, sandstone, and shale, which have been greatly disturbed by folding and faulting.

The streams are approximately graded and reach all parts of the area, so that no extensive undrained surface remains. The upland surfaces probably nearly coincide with an ancient peneplain.

The Appalachian Plateaus is practically coextensive with the Appalachian coal fields. It is relatively high, ranging from 500 feet above sea level in the Warrior coal field to more than 4,500 feet in Pocahontas County, W. Va., and about 2,000 feet in western New York. In Tennessee it slopes somewhat westward from about 2,000 feet above sea level on the east to about 1,900 feet on the west, where it terminates in the steep escarpment 900 to 1,000 feet high, descending from the Highland Rim of middle Tennessee. As a whole this province may be regarded as a series of plateaus extending from New York to Alabama, which have been more or less separated into parts or, in large areas, nearly obliterated by erosion. Because they have been so much eroded they are called dissected plateaus. The separated parts have received names, and one of them, the Cumberland Plateau in Tennessee, is the part of the province that most nearly embodies the conception of a plateau.

The rocks of the Appalachian Plateaus are mostly sandstones, conglomerates, sandstone, and shale; in contrast with those of the Valley and Ridge province the strata of the plateaus have been but slightly disturbed.

TOPOGRAPHY OF THE QUADRANGLES

The half of the Montevallo quadrangle and nearly all of the Columbiana quadrangle lie in the Coosa Valley; the rest of the area lies in the Cahaba Region. A line drawn from Cahaba to Montevallo, passing 1 mile south of Hardys, thence north to Lucy, thence due west to Germania would accurately mark the boundary between the two subdivisions.

The region is one of late mature topography. The streams are approximately graded and reach all parts of the area, so that no extensive undrained surface remains. The upland surfaces probably nearly coincide with an ancient peneplain.
in many directions, they vary greatly in breadth from point to point, and no two are alike in length. They are generally cut away all the hard-rock ledges from their beds and are much overlap each other. Some of them are raised about 10 feet to the mile. Waxahatchee Creek has a total fall in the 22.4 miles above its mouth of 6.8 feet to the mile. The profile of this stream ranges from a gentle slope to a steep rise, depending on the character of the ground. In the Montevallo quadrangle, the banks of this stream are steeply inclined and are covered with dense forest. The general character of the rocks cropping out is about 20,000 feet exclusive of the bedrock.

The generally high dip indicated along this line by the dip of the strata is interpreted as indicating a subsidence of the land in a series of large folds. The rocks have been tilted to the east, and the axis of the uplift is approximately north-south. This is the same line of uplift that is shown in the topographic map of the region. The rocks are generally inclined at high angles and striking north-south. The geologic system proposed by Ulrich 3 and named by him the Ozarkian system is adopted.

The rocks of the southeastern part of the Cahaba coal field, in the Montevallo quadrangle, are shale, sandstone, and conglomerate. The general character of these rocks is indicated by the presence of ripple marks and other sedimentary structures. The beds are generally parallel, and the dip of the strata is toward the west. The beds are thin, and the thickness of the strata decreases rapidly with distance from the center of the field. The rocks are generally composed of fine-grained sedimentary materials, and the color is generally gray or grayish white. The rocks are generally unfractured and exhibit a continuous bedding. The thickness of the strata is greatest near the center of the field and decreases rapidly with distance from the center.
...into the three formations named. Lithologically, there is little difference between the Washatche and Wash Creek slates. Even the Brewer phyllite differs from the slates little except in color, but it is the key to the structure and the stratigraphic relations of the mass. The area underlain by these rocks is one of low, rolling topography known as the Stump Hills. (See pi. 3.)

Age and correlation.—It is believed, as a result of a fairly continuous tracing, that the lower part of the Talladega slate of the Alabama system is the detached overthrust of a series of slates south of Columbus, in the Columbus quadrangle, with the main body of Talladega rocks further east. The main Brewer phyllite has been adopted for this formation because its outcrop passes near Brewer School, 6 miles south of Shelby. Purple crumpled and banded slate is the road at the schoolhouse and immediately north of it is not regarded as belonging to the Brewer phyllite, the main body of which, strongly and characteristically purple, passes a quarter of a mile west of the schoolhouse. The Brewer was originally treated as a member of the Talladega slate but is here raised to the rank of a formation.

**WASH CREEK SLATE**

**Note.**—The name Wash Creek slate is here introduced for the great body of slate overlying the Brewer phyllite in these quadrangles. The name is taken from Wash Creek, south of the Talladega slate, in the Columbus quadrangle.

**Distribution.**—The Wash Creek slate crops out across the southeastern part of the Columbus quadrangle and extends about 1 mile into the Montevallo-Colinian area. It extends farther north along the Columbus syncline to a point 6 miles north of the southern line of the quadrangle. Rocks that underlie the Wenner formation in Columbus Mountain should possibly be assigned to this formation.

**Character.**—The Wash Creek slate is very much like the Washatche slate. A considerable thickness at the bottom, lying between the Brewer phyllite and the formacious sandstone, is absent. The slate is thin, and broken by small lenses of sandstone. It is usually flattened by pressure, forming large, irregular slabs that are often 30 feet long. The direction of the movement seems to be from west to east. The movement appears to have been caused by the gravity of the heavy slate beds that overlie it.

**QUARTZITES AND CONGLOMERATES**

**Note.**—Overlying the Washatche slate is a persistent series of quartzites and conglomerates, showing in alternate bands of quartzite and pebbly grey phyllite. These rocks are greyish to white in color, with a thin, nearly continuous succession of pebbles. The quartzite is mostly a fine-grained, white, or grey, slightly cleaved rock, with a granular texture. The pebbles are greyish, black, and white, with a few lenses of black slate. The rocks are fine-grained, with a nearly continuous succession of pebbles. The quartzite is mostly a fine-grained, white, or grey, slightly cleaved rock, with a granular texture. The pebbles are greyish, black, and white, with a few lenses of black slate. The rocks are fine-grained, with a nearly continuous succession of pebbles.}

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the section on structure (p. 12), the smaller area is an unconformable relation to the Waxahatchee slate below the overthrust mass of Weisner rock lying on Conasauga limestone. As more fully described in rocks above. It belongs to the main and supposedly original northeast corner of the Columbiana quadrangle, of which the slate inclosing five or more quartzite members, 3 to 100 feet overthrust mass mentioned on page 12.

Conasauga ("Coosa") limestone. Lower, Middle, and Upper quadrangles include, in ascending order, the Weisner formation, the Rome, and the Shady limestone. The name Weisner quartzite was introduced in 1890, from Weisner Mountain, in Cherokee County, Ala., and the type section was located on the Ocampo Railroad in the NW. 1/4 sec. 34, T. 21 S., R. 1 E., barytes is scattered over a small area on the highway from Montevallo to Maylene, between Montevallo and Ophir, and is especially thin and weathered to a soft yellowish or yellowish-green shale. The lowest quartzite bed, assumed to be the base of the Weisner formation, is about 100 feet thick, as measured on the base of the Weisner formation in this region, allowing 100 feet for the unsuspension beds at the top, as mentioned above, is in round numbers 1,700 feet. As the dip is regular and the sequence apparently undisturbed, this determination seems reliable.

Age and correlation. —No fossils have been found by the writer in the Weisner rocks of Alabama or reported by others, except by Walcott as of Lower Cambrian age. No fossils were found in the limestone in the area here described. Above this limestone in Columbus Mountain is a formation of the same character as the Wintonian of Tennessee. The limestone is therefore preserved by its stratigraphic relation to be the same as the Shady. The Shady is also correlated with the Liberty limestones of Pennsylvania and Maryland. Fossils found by Keith in the base of the Shady in Tennessee were identified by Walcott as of Lower Cambrian age. No fossils were found in the limestone in this area.
The thickness of the Rome in the Columbiana County formation is less than 200 feet thick in a few localities, but not exposed, owing to the fact that the Rome of the Montevallo-Columbiana quadrangle is well exposed and the presence of the interbedded strata of yellowish-green flaky shale is clearly apparent, although the shale does not crop out extensively. In the Conasauga area, this phenomenon is especially noticeable in the Rome formation, as it is exposed in the vicinity of Blaine, 3 miles east of Center, the county seat of Cherokee County. These forms are especially important because of their manner of occurrence and because they are correlated with the Rutledge limestone of Tennessee and with the age of the Upper Cambrian, possibly that the Upper Cambrian is represented in the upper third of the formation. The presence of the interbedded strata of yellowish-green flaky shale is clearly apparent, although the shale does not crop out extensively.

In these areas the Conasauga is composed of limestones and shales. The following section will give a fair idea of the occurrence of the Rome formation, but the horizon of the collection half a mile west of Montevallo is about at the base of the upper third of the formation.

One of the fossils named belongs in an assemblage of genera elsewhere occurring, so far as known, only in formations of Middle Cambrian age. As representatives of this assemblage are known to range through the lower two-thirds of the Conasauga in the vicinity of Montevallo, and as no distinctly Upper Cambrian fossils are known from any part of the formation in these quadrangles, it may be that the entire formation of this age is present in the upper third of these areas. In these areas the Conasauga is composed of limestones and shales. The following section will give a fair idea of the occurrence of the Rome formation, but the horizon of the collection half a mile west of Montevallo is about at the base of the upper third of the formation.

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Upper Cambrian age. If this apparent difference in age should be verified by future investigation, it may prove desirable to remove the beds of the southeastern belt from the Conasauga and give them a new formation name, leaving the present name to apply in the northwestern belts, which are physically continuous with the Conasauga of the type locality.

**CUMBERLAND OR CUMBERLANDIAN SYSTEM**

Pending a decision as to the adoption of Ulrich’s proposed Ordovician system, which would include in second order the Brierfield, Ketona, Bibb, Copper Ridge, and Chapelle dolomites as in the Virginia Geological Survey as of Cumnard or Ordovician age. This great mass of dolomite, composing most of the Knox dolomite of earlier reports on this region, is 5,000 to 5,600 feet thick and is lithologically absolutely distinct from the immediately underlying Upper Cambrian. Except for a rare occurrence of *Cyrtopore*, the lower half of this mass is non-fossiliferous so far as known, and the fossils contained in the upper half are unknown on any rocks of Cambrian age. Except where the Brierfield dolomite is present and perhaps there also this dolomite mass is separated from the underlying Upper Cambrian by a strong unconformity.

**BRIERFIELD DOLOMITE**

Note.—The Brierfield dolomite was named by Ulrich from the town of Brierfield, in the Montevallo quadrangle, which is situated upon an outcrop of it.

**Distribution.**—The Brierfield dolomite crops out in a broad belt from the southwest corner of the Montevallo quadrangle to Ebenezer Church, but the outcrop is offset at Brierfield and Wilton. Its area is either low ground or low rounded ridges such as that on which Montevallo is situated. It does not appear in a deep, rich red soil, and the unknown area where it is exposed along roads and in washes, is full of chalky-weathering, crumbling chert. It possesses those distinguishing characteristics throughout this area and can be identified with certainty. At Dogwood the characteristic weathering phenomena so well displayed in a cut on the Southern Rydery at a fine point west and southeast of Dogwood. North of Dogwood the dolomite area on the west should fall into the Brierfield-striatigraphically and, and, although the dolomite in this area presents marked differences as to color and silica content from the typical Brierfield further south, it is nevertheless regarded as the Brierfield with a modified aspect.

The best exposures of the Brierfield dolomite is on Sixmile Creek for a mile or more below Sixmile Creek, where all aspects of the formation are displayed. Nearly as good an exposure is on Sixmile Creek in Municipal. In that town, the ridges of northeast of it being bounder of the chert from the lower part of the Brierfield lie on the surface. The contact of the Brierfield and Ketona and the upper 100 to 200 feet of the Brierfield are well shown on Malan Creek three-quarters of a mile northwest of Brierfield.

**Character.**—The dolomite is a thin-bedded fine-grained siliceous-blue rock and is highly siliceous. Specimens collected at Brierfield contain on the average 40 per cent of insoluble matter, nearly all silica. Except for the silica the rock is composed almost wholly of calcite. The dolomite contents nearly in the dolomite ratio, which is 54.1 per cent of calcium carbonate and 45.7 per cent of magnesium carbonate. Many of the layers of dolomite on the north and northeast show very characteristic bedding. This characteristic is well shown in the form of a quartz, which fills the cracks and apparently also replaces the dolomite. No elastic grains could be found, but it appears that the silica was precipitated from solution along with other minerals from the rock and afterwards crystallized in the cracks. In the lower part of the formation the part of the sill which forms the base of the chert from the lower part of the Brierfield takes the form of a great chert, but throughout the rest of the mass it occurs disseminated. Upon the weathering of the dolomite the alluvium forms a cavernous crust or a fine boulderwork of ridges upon the surface of the rocks, and on complete solution of the carbonates the alluvium consists of larger or smaller rounded boulders with a highly characteristic cavernous structure. (See pls. 6 and 7.) These products of weathering are so distinctive as to render the identification of the formation at first glance certain, whether the rock is exposed or under a cover of soil. The siliceous crusts and boulders from the Brierfield usually weather down to a chalky powder, thus differing from the dense, tough chert of the Copper Ridge dolomite, which forms the rounder masses and breaks down into fine angular fragments.

**Thickness.**—The thickness of the formation appears to be at least 1,250 feet on Sixmile Creek, where the conditions for measurements are favorable.

**Age and Correlation.**—The only fossil seen in the Brierfield is a root-fragment. Ophiuroidea, probably of Ordovician age, of which a number of casts heads 6 to 18 inches in diameter, forming a sort of root, were seen on Sixmile Creek 1 mile west of the town of Brierfield. The Brierfield is thus seen outside of the area mapped here. It is believed to be equivalent to part of the Gatsburg formation of central Pennsylvania, which is of very similar character and lies in the same stratigraphic position above the Upper Cambrian (Waterhouse) limestone. The Gatsburg is in part at the base of the Potomac sandstone, and in its final, from which it follows that the Brierfield is in part of the age of the Potomac. The Ophiuroidea mentioned above is abundant in the Hoyt limestone at the base of the Brierfield, and it is supposed to thin out and disappear east of Ryn, leaving the Ketona and Copper Ridge in unconformable contact north of that point. The formation is best exposed at Stables, in the vicinity of Brierfield, and along Spring Creek northeast of Montevallo. At Sixmile the exposure begins at the mill and extends down the creek for about a hundred feet.

**Character.**—As shown in the Sixmile section, immediately west of the town of Brierfield, the Brierfield dolomite is a very thick bedded, highly siliceous dolomite, in all respects similar to the Brierfield. Indeed, if it were not for the presence of the Ketona between them the Brierfield and Ketona could not be separated but would be treated as a single formation.

**COPPER RIDGE DOLOMITE**

Note.—The Copper Ridge dolomite, from a contemporaneous formation passing northward from Knoxville, Tenn., as now used applies to all the rocks (chiefly dolomite) underlying the Chapelle dolomite and overlying the Brierfield. The Copper Ridge dolomite of Alabama is believed to be equivalent to the Copper Ridge of Tennessee, which, although named, is not chert but dolomite.

**Distribution.**—The Copper Ridge dolomite crops out in four areas in the Montevallo quadrangle—a small area on the west side 1 mile north of Little Cahaba River; in Pine Ridge, the southern continuation of Newchee Mountain, east of the Beaverdam Creek and Shoal Creek lines of markers; in 8 miles northeast of Knoxville, Tenn., as now used applies to all the rocks (chiefly dolomite) underlying the Chapelle dolomite and overlying the Brierfield. The Copper Ridge dolomite of Alabama is believed to be equivalent to the Copper Ridge dolomite of Tennessee, which, although named, is not chert but dolomite.

**Character.**—The Copper Ridge dolomite is a medium to dark gray dolomite with an occasional grain of mica. The rock is so friable that it is not possible to weather a core representative of the formation.

**Thickness.**—The thickness of the formation varies from place to place, and is not very uniform. It has been estimated to be at least 2,500 feet thick in the vicinity of the town of Elizaville, and 2,000 to 2,500 feet thick in the vicinity of Montevallo. It is a thick-bedded, fine-grained, highly siliceous dolomite, in all respects similar to the Brierfield. Indeed, if it were not for the presence of the Ketona between them the Brierfield and Ketona could not be separated but would be treated as a single formation. On account of this likeness to the Brierfield further description of the Brierfield will be omitted. The area underlain by the Brierfield, like those underlain by the Brierfield and Ketona, are prevalently low and covered by a thick red soil.
The Chepultepec dolomite was named by Ulrich 14 from the town of Chepultepec, in Murfreesboro Valley, 30 miles northeast of Birmingham, near which the formation is well exposed and has yielded the most species and best preserved specimens of its characteristic fauna that have been found in Alabama. As now defined it overlies the Copper Ridge dolomite and is uniformly distributed, so that search seldom fails to be rewarded by a few specimens. The formation is characterized by several species of a genus of gastropods, Lepidoceras, of which L. imperfectum, long known as Ophistodea, is an example. There are other forms, but the Lepidoceras is the most common and is present at the Longview horizon all along the Valley and Ridge province through Tennessee and Virginia. It is also characteristic of the Naylor dolomite in central Pennsylvania and of a zone 350 to 430 feet above the horizon of the typical Beds of New York, with which the Longview limestone is correlated. The Naylor and another gastropod, Rosicamptis, also correlates the Longview limestone with the Cambrian formation of New York.

**Newala Limestone**

Noes.

The Newala limestone is named from Newala, a post office on the Southern Railway between Montevallo and Columbiana, near which it is fairly well exposed and is quarried for firebrick.

So far as known the chalk-yielding Longview limestones passes into the pure Newala limestone by gradational change. Locally, as half a mile north of Alabaster, the top of the Newala is near a conglomerate or conglomeratic limestone that forms the bottom of the Leonard formation. (See Bessemer-Vanvliet folio (No. 221), p. 7.)

**Delaware Limestone**

The Newala limestone is present in Cabala Valley and throughout the region east of the valley. There is an area on Little Cahaba River near the west edge of the Montraville quadrangle, a wide belt extending in general northward across the east half of the quadrangle, a belt of less length extending from Odessa to the south boundary, and one large and two small areas in the southwestern part of the Columbiana quadrangle.

Proceeding to the east quadrangle, we find the Newala limestone in the northeastern part of the Montevallo quadrangle, but it is probably present in those parts and included in the areas mapped as Novela and Chepultepec.

**Chepultepec**

The Longview limestone is made up of alternating layers of limestone and dolomite or magnesian limestones. It seems to contain a greater proportion of dolomite than the overlying Novela limestone and is distinguished from the underlying Chepultepec by its limestone, of which the upper part of the Chepultepec is practically destitute. Another distinguishing feature of the Longview is its chalk, which is compact and not cavernous and mealy as in the Chepultepec. It is also brittle and tends to break down into small fragments. The overlying Novela limestone yields little chalk.

**Thicknes.**—The thickness of the Longview limestones west of Pallman is at its thinnest where it is most nearly located, is about 400 feet.

**Age and correlation.**—The Longview is a sparingly fossiliferous horizon, but the few species of fossils are widely and uniformly distributed, so that search seldom fails to be rewarded by a few specimens. The formation is characterized by several species of a genus of gastropods, Lepidoceras, of which L. imperfectum, long known as Ophistodea, is an example. There are other forms, but the Lepidoceras is the most common and is present at the Longview horizon all along the Valley and Ridge province through Tennessee and Virginia. It is also characteristic of the Naylor dolomite in central Pennsylvania and of a zone 350 to 430 feet above the horizon of the typical Beds of New York, with which the Longview limestone is correlated. The Naylor and another gastropod, Rosicamptis, also correlates the Longview limestone with the Cambrian formation of New York.

The Chepultepec has yielded a considerable number of fossils which have been found in the Chepultepec of the Montevallo and Columbiana quadrangles. In Urich states that 17 of these 31 species occur in Missouri in the Chepultepec dolomite, of which the upper part of the Chepultepec is practically destitute. Another distinguishing feature of the Longview is its chalk, which is compact and not cavernous and mealy as in the Chepultepec. It is also brittle and tends to break down into small fragments. The overlying Novela limestone yields little chalk.

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**Newala Limestone**

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The Newala limestone is best developed in the Little Cahaba section, in the southwestern part of the Columbiana quadrangle. It can also be seen in the section and adjacent ground in that part of its area lying approximately north of Varna. In the southeastern part of the Columbiana quadrangle exposures are so few and incomplete that a satisfactory examination can not be made.

The best exposure is along the Bessemer and Bailey Creeks for a mile or so above their mouths, on Spring Creek at Kwashinickie, south of Montevallo, and just north of the highway along the south side of sec. 30, T. 30 S., R. 1 E. These are also excellent exposures in the area northeast of Columbiana west of Nelson, where the Newala has all the features characterizing it in Cabala Valley.

**Character.**—The Newala is predominantly a limestone. Comminuted thick-beds is the rule. (See p. 8.) Layers of dolomite a few feet thick occur here and there throughout the name, more commonly in the lower part, but compose a small part of the whole formation. Some of them 50 feet thick, occur in the upper part of the Newala just north of Odessa. Most of the dolomite is gray and coarse grained and has a sandy appearance on the outside, so that it is mistaken for sandstone by the quarrymen. Thick layers, composed partly of limestone and partly of dolomite, are irregularly distributed. These are called nodular limestones. The limestones vary in color and texture. In some beds it is dark gray and grayish, in others dover-colored and fine grained or amorphous. These nodules are spherical in form and sometimes colored. They are composed of nodular limestones and may be associated with nongranular or amorphous texture and very brittle, with a splintering or gummy fracture. Except for the clear calcite specks it has much the appearance of a bioclastic stone. Thick layers are characterized by the presence through extensive areas suggesting a large sand in the southern Appalachian region. This character...
The thickness of the Newala in the Little Cahaba section, on the east side of the Montevallo quadrangle, is 800 feet; in the eastern outcrops it appears to be somewhat greater, perhaps 1,000 to 1,200 feet. In the eastern part of the Cahaba section the thickness seems to be much greater than elsewhere, but owing to uncertainty as to the geologic structure no estimate of the thickness is made.

Age and correlation.—Fossils are fairly common in the Newala but as a general rule are not liberable from the matrix on weathering and can not be excised by breaking. They are generally revealed as sections of slates on limestone surfaces made smooth by weathering. From these sections their general character can be made out, but, except for one or two species, class specific distinctions can hardly be made. The fossils are nearly all gastropods. One of the most characteristic forms is Conosites bold, a supposed species of an unknown gastropod. Another form that can be identified with reasonable certainty is Leporella, a slender high-spired form of 10 or 12 whorls. Still another form of the same type is compared with Conoceras (Merobrachius) linearis.

These forms, especially the Conosites and Heteroceras, are common in limestones in the same general position as the Newala, overlying beds carrying Leporella, which extends the entire length of the Appalachian belt from the southern border of Pennsylvania to the north and south of the Newala limestone where the Odenville is absent, and was succeeded above by the Lenoir limestone. In these quarries the Newala is overlain by an erosion unconformity.

In the northern part of Cahaba Valley the Odenville limestones come between the Mosheim and the top of the Newala. The Odenville limestones, as far as is known, are not present in Tennessee, the Mosheim resting directly upon the Knox, the upper part of which is equivalent to some part of the Newala limestones.

Distribution.—In Alabama the Odenville is exposed in a borrow pit on the Southern Air Line Railway east of Odenville, St. Clair County; in Cahaba Valley at Newhope Church, 7 miles north of Pelham, and in the Cahaba quadrangle in the road in the N. w. sec. 11, T. 24 N., R. 15 E. Doubtless it formerly extended over the northeastern part of the state, west of Montgomery, the Newala, or the Odenville limestones where the Odenville is absent, and was succeeded above by the Lenoir limestones. In these quarries the Newala is overlain by an erosion unconformity.

Character.—The Odenville is a pure thick-beded white or dune-colored limestone, and it forms a white chalky crust on weathering. By these characteristics it is easily distinguishable from the Lenoir limestone, which is dark, Emily-colored, and contains fossil laminae that crumble to small nodules on weathering.

Thickness.—At Odenville the Odenville is about 50 feet thick, and in places has been observed throughout its extent in the state.

Age and correlation.—The Odenville is in places full of gastropods of Ordonovian type, large, high-spired Lophopores being prominent. At Odenville gastropods are plentiful as individuals, and there are perhaps a dozen species among which are figured in Plate 19 of the "Geology of Alabama." The Odenville is clearly to be regarded as basal Chazy in age and in southeastern Virginia has nearly been found to occupy a position between the Lenoir limestone and the Middle Chazy limestone. So far as known it has no equivalent outside the Valley and Ridge province.

ODENVILLE LIMESTONE

Odenville limestone was named by Hayes from Odenville, St. Clair County, the limestone being partly exposed in the west end of a borrow pit of the Seaboard Air Line Railway about a third of a mile east of Odenville, sec. 11, T. 24 N., R. 15 E. Doubtless it formerly extended over the northeastern part of the state, west of Montgomery, now as the Newala, or the Odenville limestones where the Odenville is absent, and was succeeded above by the Lenoir limestones.

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LENOIR LIMESTONE

Lenoir limestone was named by Safford and McGuire Ford. At this place the basal layer of the Lenoir is limited above by the persistent and easily recognizable black shale known as the Athens shale.

Distribution.—In Alabama the Lenoir is exposed in a cut a quarter of a mile east of Hardys station, between Calera and McGuire Ford. At this place the basal layer of the Lenoir is limited above by the persistent and easily recognizable black shale known as the Athens shale.

Character.—The Lenoir is dominantly a very dark to black medium-grained thick-beded limestone. Layers of dune-colored nongranular limestone occur in its middle part, and light-gray to nearly white layers near its base. Many of the limestone layers contain cherty material distributed in intersecting laminae throughout their thickness, and the edges of these laminae are narrow gray ridges that make a network of about 1 inch wide in the Cahaba quadrangle. Another form is the great flat-spired gastropod known as Maclurea magna, on account of which Safford originally called this formation the "Maclurea limestone." In Cahaba Valley south of Pelham the Lenoir is limited above by the persistent and easily recognizable black shale known as the Athens shale.

Distribution.—In Cahaba Valley from the Frog Mountain sandstone below. The strike in this locality is unknown and probably not determined because of the lack of exposure and the evidence seems sufficient for correlating the Lenoir with the Middle Chazy. It is correlated else with the Pottsville and Etna limestones in the middle of the Stones River group of the Nashville Basin, Tenn., Maclurea magna having been found, according to Ulrich, in the Athens shale.

ATHENS SHALE

The Athens shale was named by Hayes from Athens, Tenn., where it is strongly developed.

Distribution.—The Athens shale occurs in a narrow semiconcentric strip running across the east side of the Montevallo quadrangle. The Athens is 12 miles west of the Athens, Tenn. railroad station. A small northeasterly exposure 6 miles south of South of Columbus is north of the exposed arkose at its horizon, but as it is not known to be absent it is assumed to be present and so mapped. From scattered exposures in the eastern part of the Cahaba quadrangle its presence near the top of the limestone beds throughout this general region is somewhat doubtful, but as it is not mapped as everywhere present. It was recognized by its graptolites on the Finley farm, in the SW 1/4, sec. 34, T. 21 N., R. 1 E., also at the highway crossing of the Louisville & Nashville Railroad a little more than a mile southeast of Kewahatchie. In the road 1 mile west of Woods Ferry a wedge of Athens about 100 feet thick, with graptolites, is faulted in between highly fossiliferous Floyd shale on the west and what is apparently Fort Payne chert on the east. The extent of its outcrop along the strike in this locality is unknown and probably not determinable because of the lack of exposure and the evidence seems sufficient for correlating the Athens with the Lenoir shale. It is correlated else with the Pottsville and Etna limestones in the middle of the Stones River group of the Nashville Basin, Tenn., Maclurea magna having been found, according to Ulrich, in the Athens shale.

LENOIR AND ATHENS SHALE

The thickness of the Athens is very uncertain. The greatest thickness determined is at Simpson Spring, 2 miles northwest of Columbus. Graptolites are plentiful in this locality. The upper part of the Athens is best displayed in a cut on the Southern Railway half a mile east of Columbus and at a cut a quarter of a mile east of Hardys station, between Calera and McGuire Ford. The exposure half a mile south of Columbus is shown in Plate 9, and sections are given in the description of the Four Mile chert conglomerate. The Lenoir limestone is 200 to 500 feet thick, and its full thickness may be somewhat greater, for the bottom could not be certainly located. Just east of Salem Church and there is another exposure of a mile west of

...
The Little Oak limestone is named from Little Oak Ridge, northeast of Pellman, in the Beemster quadrangle, on account of its good development and exposure along the west margin of the ridge.

Distribution.—In the quadrangles where the Athens is succeeded by the Frog Mountain sandstone (see pl. 10) there is a great stratigraphic gap caused by the absence of all the Ordovician below the Athens, the whole Silurian system, and the lowest Devonian (Helvetian). In central Pennsylvania the thickness of the strata in this interval amounts to about 6,000 feet.

DEVIANT SYSTEM

The Devonian system is represented in this part of Alabama by the Frog Mountain sandstone and possibly by the Chatta­mona sandstone, but the age of the Chatta­mona is in dispute.

NAME

The Little Oak limestone is named from Little Oak Ridge, north of Pellman, in the Beemster quadrangle, on account of its good development and exposure along the west margin of the ridge.

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FROG MOUNTAIN SANDSTONE

The Frog Mountain sandstone is everywhere thin in the vicinity of Calhoun and north to Hartselle, ranging from a few inches to a possible maximum of 3 feet. In the southeastern part of the Columbus quadrangle it appears to be generally about 50 feet thick and locally may reach 100 feet.

Age and correlation.—It has been customary to apply the name Frog Mountain to any Devonian sandstone in northeast Alabama, especially in the northeastern portions of the state, and to regard it as of Ordovician age. However, it has been learned through investigations of the last few years that the typical Frog Mountain sandstone of the Little Oak limestone and Floyd shale of the northeastern trough of the Appalachian Valley. The Chatta­mona and Fadrodeolactides near P. pisum (Clypeorhynchia) ________ 9

Cariculina abdita Butts. ______ 1

DESCRIPTION OF THE SANDSTONE

The Frog Mountain sandstone is everywhere rather coarse grained, firmly cemented, hard, quartzitic, and light or dark gray. At some exposures a few inches at the top it is friable and ferruginous. At one place this top layer contains obsolete markings resembling fossils but no identified fossils were discovered. The sandstone in the Kelley Mountain antline is thick bedded, coarse, hard, and of a peculiar dark color quite different from that of the typical Frog Mountain sandstone.

Thickly.—The Frog Mountain is everywhere thin in the vicinity of Calhoun and north to Hartselle, ranging from a few inches to a possible maximum of 3 feet. In the southeastern part of the Columbus quadrangle it appears to be generally about 50 feet thick and locally may reach 100 feet.

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Thickly.—The Frog Mountain is everywhere thin in the vicinity of Calhoun and north to Hartselle, ranging from a few inches to a possible maximum of 3 feet. In the southeastern part of the Columbus quadrangle it appears to be generally about 50 feet thick and locally may reach 100 feet.
If these conclusions are correct, there is a stratigraphic gap classified as Devonian, but the correctness of that determination has been questioned, and some geologists regard the Chattanooga probably absent. Southward from the localities mentioned the formation gradually thins and is represented in slaty shale 20 to 30 feet thick. Southward and southeastward. In the southeastern part of the Chattanooga the Chata­
nouga is probably present is in the strip at T. 22 S., E. 1 E.

Age and correlation.—The Chattanooga shale has been classified as Devonian, and according to Nyblom the Chattanooga is a Devonian formation can not be followed continuously and was nowhere shown by specimens brought up from considerable depths as if the beds were absent. South of the Chattanooga and thins southward and southeastward. In the southeastern part of the Chattanooga it appears to be thin, and in the southwestern part of the Chattanooga it is probably not more than 30 feet thick.

Age.—The Fort Payne is known through its fossils and through tracing into the Chattanooga and southeast of Bessemer anticline. According to Washburne, the formation gradually thins and is represented in slaty shale 20 to 30 feet thick. Southward and southeastward. In the southeastern part of the Chattanooga the Chattanooga has not been recognized and is probably absent.

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A few fossils, including Leptonychites carboniferus, were collected on the Tuscaloosa road in sec. 35, T. 22 S., R. 2 W. of the Collierville quadrangle. Lists of these fossils are published elsewhere.

Stone and Floyd shale of Shades Valley, in the Bessemer quadrangle, are sufficient evidence of the Chester age of the Floyd.

The thickness of the Floyd is probably not more than 1,000 feet, although the generally steeply inclined attitude of the formation and its wide extent might give the impression that it is many thousand feet thick. The true thickness is best determined in the belt just north of Regilla. Here the bottom of the Floyd is clearly defined by the Payne chart and by the top of the Floyd, which is the boundary between the Parkwood and Potteville.

Age and correlation. — In Shades Valley, in the Bessemer quadrangle, where the Parkwood is about 2,000 feet thick, a collection of fossils was obtained from a sandstone about 500 feet below the top. In the southeastern corner of the Bessemer quadrangle and apparently about 500 feet above the bottom of the Parkwood fossils of unmistakable Mississippian age are present. These fossils are listed in the Bessemer-Patteville folio. It appears, therefore, that where the sediments of Parkwood type attain their maximum thickness they probably transgress the paleontological and geologic boundary between the Mississippian and Pennsylvanian systems.

The thickness of the Parkwood is probably not more than 1,000 feet, although the generally steeply inclined attitude of the formation and its wide extent might give the impression that it is many thousand feet thick. The true thickness is best determined in the belt just north of Regilla. Here the bottom of the Floyd is clearly defined by the Payne chart and by the top of the Floyd, which is the boundary between the Parkwood and Potteville.

The Parkwood formation is in the vicinity of Osmer, where it is nearly all exposed, and along the Southern Railway west of Gentry Gap, both places in the Bessemer quadrangle. In the Montevallo and Columbiana quadrangles the formation is known by the name of the brownish shale of the Parkwood. The Parkwood is widespread in the Montevallo and Locust Ridge, within Stony Ridge in the northeast corner of the Montevallo quadrangle.

The Parkwood is more than 1,000 feet thick, in the eastern areas of outcrop, however, the Parkwood is greatly truncated by erosion. The Parkwood is about 400 feet thick in the Montevallo quadrangle and Locust Ridge, within Stony Ridge in the northeast corner of the Montevallo quadrangle.

The Parkwood formation contains several beds of siliceous sandstone and conglomerate known collectively as the "Millstone grit." The presence of these hard, resistant beds, inclined 15° or more, has the controlling influence of the formation of the high ridges along the northwest border of the Cahaba and Coal fields, such as Shades and Pine Mountains of the Cahaba field and Backbone, Oak, and Double Oak Mountains of the Coosa field.

The Potteville in the deepest part of the Cahaba coal field in the Maysville Basin is about 9,000 feet thick and it is the part of the coals in these quadrangles about 5,000 feet thick. The Maysville Basin probably holds the youngest Paleozoic rocks in Alabama.

Shades sandstone member.—The Brock coal, at the base of the Parkwood in the Birmingham quadrangle elsewhere, is generally overlain by 40 feet or more of shale, shale which is the Shades sandstone member, named from Shades Mountain, in the Bessemer quadrangle. In this area described, however, the Brock coal is known only in the northeastern corner of the Montevallo quadrangle and is confined to the southeastern corner of the Montevallo quadrangle. The Shades is thick bedded, rather coarse, and generally amorphous conglomeratic in the lower part. It is 300 feet thick. Its basal 400 feet or so are cut out against the slope along Shades Mountain almost the entire length of the Cahaba field. It crops out for about 1 mile across the northwest corner of the Montevallo quadrangle and makes the west edge of Double Mountain, which extends around the south end of the Yellow Leaf trough in the northwest corner of the Montevallo quadrangle.

Pennsylvanian series

Potteville formation

Name.—In Shades and Cahaba Valleys, mainly north of these quadrangles, on the west side of the Cahaba and the Coal coal fields, are shales and sandstones named the Parkwood formation, from the town of Parkwood, which is situated upon the formation. The Parkwood is defined as including the 1,500 to 2,000 feet of sand and shale lying above the base of the sandstone making Little Shades Mountain and Bald Ridge, half a mile west of Osmer, and below the Brock coal bed, which is taken as the base of the Potteville formation.

Distribution.—The best exhibition of the Parkwood is in the vicinity of Osmer, where it is nearly all exposed, and along the Southern Railway west of Gentry Gap, both places in the Bessemer quadrangle. In the Montevallo and Columbiana quadrangles the formation is known by the name of the brownish shale of the Parkwood. The Parkwood is widespread in the Montevallo and Locust Ridge, within Stony Ridge in the northeast corner of the Montevallo quadrangle.

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The Potteville in the deepest part of the Cahaba coal field in the Maysville Basin is about 9,000 feet thick and it is the part of the coals in these quadrangles about 5,000 feet thick. The Maysville Basin probably holds the youngest Paleozoic rocks in Alabama.
As there is no direct connection between the several coal fields, it is necessarily dependent on fossil plants or stratigraphic relations for correlating the coal beds. From fossil plants David White makes the correlations between the Warrior and Coal River systems. The Carboniferous is divided into five orders of which the main one is the Pennsylvanian, which includes the Tuscaloosa, the Pottsville, and the Alleghany systems. The lower Pottsville includes the Tuscaloosa, and the upper Pottsville includes the Alleghany. The corresponding divisions in the Alabama coal field are indicated in Figure 5 of the Bennett-Vanderbilt folio. Lists of the fossils occurring in the Pottsville of Alabama are published in the Bennett-Vanderbilt folio.

**Tuscaloosa System**

In this part of Alabama there are no records corresponding to a great sequence found in other parts of the United States, including the upper part of the Pottsville and the Alleghany, Conemanong, Monongahela, and Penns formations of the Carboniferous of the northern Appalachians, as well as the entire Trassic and Jurassic systems and the Lower Cretaceous of other parts of the world. There is thus a very great stratigraphic gap between the Cretaceous rocks of this region and the youngest rocks underlying them.

**Cretaceous System**

In this region the Cretaceous system is represented by the Upper Cretaceous Tuscaloosa formation, which is present at several scattered outcrops and masses near the Northern part of the main zones of the formation.

**Tuscaloosa Formation**

**Name and relations.**—The Tuscaloosa formation was named from Tuscaloosa, Ala., where it is typified developed. It rests unconformably upon all the formations of the region from the Tuscaloosa, in the southwestern part of the Montevallo quadrangle, to the Pottsville, 2 or 3 miles west of the Montevallo quadrangle.

**Distribution.**—The Tuscaloosa formation is distributed irregularly in these quadrangles. Apparently the map indicates an area in which the continuous area and the greatest thickness are on the ridge west of the Cretaceous rocks in the southwestern part of the Tuscaloosa syncline. In this general region the Tuscaloosa is extensively distributed but has knobs of dolomite and chert protruding through it, showing that it was laid down on a knobs of dolomite and chert.

**Structure**

The Tuscaloosa formation is represented in these quadrangles by a series of cliffs that extend upon the foot plains of the present streams. Wells near Curry Ford show a thickness of 40 feet for the alluvium, which at that place consists of sand, clay, and gravel.

**Method of representing structure.**—The structure is shown on the map by structure sections, which show how the outcrops of the strata vary in an east-west direction through the region at right angles to the strike of the rocks. This method is very instructive, but it has the disadvantage of showing the strike of the strata only as a line of dots. This method is the best method where the rocks are mostly flatbed and faulted.

**General features of the structure.**—In these quadrangles, throughout the Valley and Ridge province, the rocks, originally horizontal, have been subjected to dislocation, the broken ends of the Copper Ridge outcrop would probably be brought together in the vicinity of sec. 30, T. 21 S., R. 2 E. North of Elliottville the fault probably shifts into the midst of the Newala limestone, and the movement has followed the bedding planes of that formation and so has produced no displacement by which the movement would be revealed. This fault probably extends northeast of New Hope Church with the Cahaba Valley fault, in the Vankiller quadrangle.

The Tuscaloosa syncline is developed in the southeastern part of the Columbus syncline and northeast in the western part of Columbus Mountain. The Tuscaloosa system in Columbus Mountain appears to be in an unconformable contact with the Waxhawsches slate, as the rocks bounding the Weiser may be Wash Creek slate and the relations are not known. If they are Wash Creek, then there is an east-west fault at the southeast base of Columbus Mountain between the Wash Creek and Waxhawaches. The peculiar fact about this fault, if there is one, is that it is downthrown on the east, contrary to the rule in the Valley and Ridge province.

In a consideration of the Columbus synclines as a whole, stratigraphy, geology, and structure, the following interpretation is strongly suggested. In the Columbus Mountain region the axis of the synclines is to the southeast and the anticlines are to the northwest. This is true of the syncline to the southeast and the succession upward is Washwaches slate, quartzite, and the conclusion may be modified by the fact that the axis of the synclines is not established. The Wash Creek slate seems to be parallel to the Washwaches slate.

There is a certain degree of similarity in the stratigraphic sequence in both of these areas. At the south end of Columbus Mountain the Weiser is overlain by a layer of Washwaches type, which is apparently continuous with the Washwaches slate. In the northern part of the region the Jurassic limestone is a matter of speculation. It may have been folded and faulted, but this is not certain. This is further attested by the interpretation that the common limbs, the northwest limbs of the Washwaches synclines is extended on opposite sides of the axis anticline, as suggested by the facts. If this interpretation should prove to be correct, it follows that the rocks next above the Washwaches slate in the common part of the Columbus quadrangles are of Lower Cambrian age with higher Cambrian formations overlying them. This would leave only the age of the Washwaches undetermined.

The small area of Weiser rocks, as described in sec. 9 and 16, T. 21 S., R. 1 E., in the syncline northeast of the area of the state line. The structure of these younger formations is the depth of the Columbus syncline in the southern part of the Columbus syncline is unknown. The Wash Creek slate is of continental age, and these rocks are overlain by the Mississippian series of the state of Alabama.
to the writer to favor pre-Cambrian age for them. Sawyer limestone member have ever been discovered in them pre-Cambrian rocks elsewhere. Although they are here classi-

There was also a short period of limestone deposition, when small quartz pebbles was deposited, and this material became Cambrian or Paleozoic). At intervals coarse sand mixed with pre-Weisner (Waxahatchee, Brewer, Wash Creek) time (pre-

Ridge province and Appalachian Plateaus, are the foundation slates have been so strongly compressed that slaty cleavage has one hundred million years ago, or according to more recent hypoth-

Dip of fault planes. In Athens time this Alabama region had connection through Little Oak time marine animals, brachiopods, and gastropods, and remains of these were discharged into the Appalachian Strait by the rivers of

PALEOZOIC ERA

The Ordovician period was one of notable oscillation in the earth's crust during the long time of its accu-

The Ordovician period was one of considerable division into two periods, the Lower and the Upper Ordovician. The Upper Ordovician is divided into the Llanvirn, the Caradoc, and the Ashgill subperiods. The Lower Ordovician is divided into the Tremadoc, the Arenig, and the Rhuddanian subperiods. The Llanvirn and the Ashgill are the most important periods of the Ordovician system in Alabama.

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Theoclysculas and similar genera, as well as the aquatic isopods and crustaceans, were abundant in the fresh water pools and ponds. The small, armored crustaceans, such as Podon and Armadillidium, were widespread in the region. The freshwater mussels, such as Amythysta and Unio, were also present, with the latter species being particularly abundant in the deeper pools. The land snails, such as Helicidae and Planorbidae, were also common, with the latter being particularly well represented in the more sheltered areas of the riverbanks. The small, leafy bryophytes, such as Marchantia and Mnium, were also abundant in the shaded areas of the riverbanks.

The occurrence of these plants and animals was a result of the changed climate and topography that occurred during the Quaternary period. The increasing aridity and the retreat of the glaciers allowed for the expansion of the grasslands and the development of the savanna ecosystem. This in turn led to a greater diversity of plants and animals, with the development of specialized species adapted to the new conditions. The species listed above are a small subset of the many that existed during this time, and the full diversity of the ecosystem is only beginning to be understood.

The economic geology of this region was also greatly affected by the Quaternary changes. The煤矿s of Alabama were largely deposited during this time, and their exploitation has played a significant role in the state's economy. However, the full extent of this exploitation is still not fully understood, and further research is needed to fully appreciate the full extent of this resource.
Youngoodbed. The Youngood coal is 200 feet above the Buck. This bed has passed very rapidly over the older and younger throughout the southern part of the Cahaba field and is believed to be about 3 feet thick throughout the area of the Montevallo quadrangle. This bed was worked recently at the Delany mine, half a mile north of the Youngood and just west of the last line of the quadrangle, where it is reported to range from 2 to 4 feet in thickness without partings, with a measured distance of 30 feet from the mine mouth, as shown in section 1, Figure 5.

Clark coal bed. — The Clark bed is about 100 to 70 feet above the Bank, and, between the two beds a conglomeratic sandstone, near the west branch of Fourmile Creek, and in the western part of sec. 3, T. 24 N., R. 11 E., on the main stream. The old mine in sec. 3 has recently been reopened, and the rocks exposed are shown in section 6, figure 6.

A prospect on Little Mayberry Creek is believed to mark the outcrop of this bed, which appears to be the same as the Cooper seam of Squire, reported by him to be 2 feet thick.

Helena coal bed. — The Helena coal bed, which is about 160 feet above the Thompson, is of considerable value in the northern part of the Montevallo quadrangle but is little known in the central part. In the vicinity of Cohanor and Piner, southwest of this quadrangle, extensive prospecting has failed to discover the bed, or if found it is too thin to be worth considering.

The Swago Creek mine, where by mine levels it is 185 feet above the Thompson bed, is of good thickness and condition. (See section 1, fig. 7.) At the Superior mine, however, it is shown a similar section, and although the coal and clay benches are here somewhat uneven, the bed as a whole appears to maintain a good workable thickness. (See section 2, fig. 7.)

The bed is believed to be workable throughout the Dry Creek basin and is seen to be also in the Eureka Basin, on the north. About a mile southeast of Straven, at the northernmost end of the Maylene Basin, the bed is of good thickness and quality, and a mine opened since the quadrangle was surveyed is now operating upon it. South of the Abbeville line, on Little Mayberry Creek, Squire reported a bed of 4 to 6 feet thick and opened it as the Montevallo. This bed is for this bed to the Montevallo, and the writer regards it as probably the Helena. Except this report of Squire nothing is known of the bed in this region.

Youco bed. — The Youco bed, about 165 feet above the Helena, is of doubtful value in this area. One-third of a mile east of the Gurneys mine is an opening on a bed identified as the Youco, which is 18 inches thick and 370 feet above the Thompson coal. Prospect pit in section 4, T. 29 N., R. 5 W., is shown to be on top of this bed, but the identification cannot be regarded as satisfactory. At the opening the west side of sec. 17 the bed is 2 feet 2 inches thick, of class coal.

Montevallo coal bed. — According to calculations the Montevallo coal bed in the vicinity of Gurneys is about 800 feet above the Thompson bed and 400 feet above the Youco. This result is confirmed by the mine at the Montevallo coal bed of half a mile in advance of the workings.

The Montevallo has long been mined at and north of this bed, and always had a high reputation as a domestic coal. Along its north-west outcrop the bed is thin and partial but is to be regarded as workable, if at all, only under favorable conditions. In the SW. 1/4 sec. 18, T. 22 S., R. 4 W., the bed is 2 feet 2 inches thick, with partings. (See section 3, fig. 7.)

The coal in the thinner benches of this section is hard and bright and probably of good quality. In the south-west outcrop of the bed is thin and partial but is to be regarded as workable, if at all, only under favorable conditions.
On the contrary, at the southeast side of the field the bed is in the best condition. At the Aldrich mine the bed is not as shown in sections 4 and 5, Figure 7, which practically agreed with the examination of the bed. The section is exceptional:

**Section of Montevallo coal at Aldrich mine, cross section at entry point**

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Poor rock and clay, no coal visible</td>
</tr>
<tr>
<td>5</td>
<td>Clay, shale, and partings</td>
</tr>
<tr>
<td>6</td>
<td>Coal, shale, and partings</td>
</tr>
<tr>
<td>7</td>
<td>Coal, shale, and partings</td>
</tr>
<tr>
<td>8</td>
<td>Coal, shale, and partings</td>
</tr>
<tr>
<td>9</td>
<td>Clay, shale, and partings</td>
</tr>
<tr>
<td>10</td>
<td>Coal, shale, and partings</td>
</tr>
<tr>
<td>11</td>
<td>Clay, shale, and partings</td>
</tr>
</tbody>
</table>

The composition of the coal at the points where sections 4 and 5, Figure 10, were measured is shown in analyses 19030 and 19040. At the Little Gen mine, in the NW 1/4 sec. 5, T. 22 S., R. 3 W., the Montevallo bed has been brought up to entry point by the Dogwood Mine, the mine being situated on the north rim. The following section is representative:

**Section on main slope of Little Gen mine at seventh left heading**

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coal, shale, and partings</td>
</tr>
<tr>
<td>2</td>
<td>Coal, shale, and partings</td>
</tr>
<tr>
<td>3</td>
<td>Coal, shale, and partings</td>
</tr>
<tr>
<td>4</td>
<td>Clay, shale, and partings</td>
</tr>
<tr>
<td>5</td>
<td>Coal, shale, and partings</td>
</tr>
</tbody>
</table>

This bed is reported to persist in workable condition throughout its area of about 24 square miles in the Dry Creek beds. The quality of the coal is shown by analyses 19029 and 19028. The following are representative:

**Coal, shale, and partings**

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>19029</td>
<td>1.5% C, 56.7% H, 0.4% O, 15.8% N, 34.2% S</td>
</tr>
<tr>
<td>19030</td>
<td>1.5% C, 56.7% H, 0.4% O, 15.8% N, 34.2% S</td>
</tr>
<tr>
<td>19031</td>
<td>1.5% C, 56.7% H, 0.4% O, 15.8% N, 34.2% S</td>
</tr>
</tbody>
</table>

It is believed by the prospectors of the Montevallo-Straven coal that the coal worked at the mine is the Montevallo bed. In a preliminary report, the writer tentatively accepted this view. On further examination, however, that view has been abandoned. The objections to regarding these coal beds as Montevallo are, first, they are too far above the Thompson coal, 1,100 feet or more, whereas the Montevallo is only about 800 feet above; second, these are coals, whereas there is only one at the Montevallo horizon. It is much more probable that the Straven group is the same as the Dogwood group.13

**Dogwood group**

The Dogwood coal beds include three or four thin beds, the lowest 500 feet and the highest 600 feet above the Montevallo bed, as determined at the Aldrich and Little Gen mines. The lower Dogwood bed was once mined at the Old Exit slope, on the north rim of the Dogwood mine, where it is about 600 feet above the Montevallo bed in the Little Gen mine. What appears to be the highest bed of the group was once mined on Darrow Creek in the SW 1/4 sec. 15, T. 22 S., R. 11 E., where the distance between bed and the Montevallo is 600 feet. The Dogwood coal beds have been thoroughly prospected by the Tennessee Coal, Iron & Railroad Co., and the north end of the Maylene Beds to the Timbalier road in the northwest corner of sec. 3, T. 22 S., R. 11 E., there are three beds within a thickness of 100 feet or so. They are generally thin or so divided by partings that they are valueless, but one or another shows here and there a thin, banded ledge.

---

One of the iron ores contained more or less of impurities, such as inclusions of clay, which may rank as lean ore. They are all stratified deposits in the better grades or in the ferruginous sandstones, some of which may rank as less ore. They are all stratified deposits and in that respect resemble vein iron. The layers of the latter ore of Columbus Mountain are intersected by joints and bedding planes which divide the ore into smooth-faced rhomboidal pieces generally less than 6 inches in diameter. In the less ore and ferruginous sandstones this manner of jointing is less conspicuous.

The ore observed at the Mardis Ferry road, east of Columbiana, according to Smith, 32 is being mined. The eastern two-thirds of the ore-bearing area is underlain by Newala limestone, and the western third possibly by shale, the eastern part of the workings, and apparently only there, a white and lenticular deposit to which the ridge owes its existence. Ore occurs at a number of points in both Columbus Mountain and the ridge on the northeast part of its outcrop, where the bed of the iron mine is continuous. It has been thoroughly prospected for about 2 miles along its outcrop in secs. 7, 8, and 18, T. 21 N., R. 1 E. The ore consists of layers in shale, as shown in the following section:

<table>
<thead>
<tr>
<th>Section of ore in pit on southeast half of Byrnes hill, in NW 1/4, sec. 27, T. 24 N., R. 11 E.</th>
<th>Ft. in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shale</td>
<td>10</td>
</tr>
<tr>
<td>Shale, ferruginous, lean ore, weathered</td>
<td>10</td>
</tr>
<tr>
<td>Ore, reportedly good grade</td>
<td>10</td>
</tr>
<tr>
<td>Ore, good grade</td>
<td>10</td>
</tr>
<tr>
<td>Ore, apparently good grade</td>
<td>10</td>
</tr>
<tr>
<td>Shale, shale, and limonite</td>
<td>10</td>
</tr>
</tbody>
</table>

At this pit the strike is N. 20° E. and the dip 30° E. A little more than a mile southwest of this pit, in the NW 1/4, sec. 15, T. 24 N., R. 11 E., the following measurement was obtained:

<table>
<thead>
<tr>
<th>Section of ore bed in NW 1/4, sec. 15, T. 24 N., R. 11 E.</th>
<th>Ft. in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shale</td>
<td>5</td>
</tr>
<tr>
<td>Ore</td>
<td>5</td>
</tr>
<tr>
<td>Shale, ironstone, lean ore, weathered</td>
<td>5</td>
</tr>
<tr>
<td>Ore, apparently good grade</td>
<td>5</td>
</tr>
<tr>
<td>Shale, more or less ferruginous</td>
<td>5</td>
</tr>
<tr>
<td>Ore, good grade</td>
<td>5</td>
</tr>
<tr>
<td>Shale, apparently good grade</td>
<td>5</td>
</tr>
<tr>
<td>Shale, ironstone</td>
<td>5</td>
</tr>
</tbody>
</table>

The strike here is N. 10° E. and the dip 30° E. On the Meridan Caroll Mine, near by, and in other localities in the State where brown ores are being mined.

The region has been fully explored for ore deposits, and nothing of importance has been discovered in addition to the occurrences at Shelby and near the Bibb furnace. It seems a safe conclusion that no other limonite deposits of economic importance occur in the region.

Limonite west of Brierfield.—About 3 miles west of Brierfield is a deposit of brown ore from which ore was obtained for the Bibb furnace from the time of its establishment in 1862 until its abandonment in 1880. The furnaces were half's mile east of the ore bank and was connected by railroad with the Bibb furnace, which was located near the hamlet of the Civil War. The old diggings are in the southern part of sec. 22 and the northern part of sec. 27, T. 24 N., R. 11 E. They extended over an area of about 10 acres and reached a depth of 60 feet. The ore in red or orange-colored sand or sandy clay, containing also many charred boleus and much smaller charcoal. The deposit is underlain by Katoa and Breidolt dolomites. At one point in the bottom of the ore pit a projecting mass of dolomite, and not more than 300 feet distant on the same line is an exposure of very fine-grained chalky clay, which contains clearly of Cretaceous age. Apparently the limonite (clay) deposit in the bleached dolomite and subsequently covered by mud and clay, probably derived for the most part from the adjacent ridge, which also furnished the intercalated chert debris. In this heterogeneous mass of ore the material occurred as long roots. According to report, no ore occurs in the variegated chert at the bottom. The ore appears to be of the same type as in the Shelby bank, being in compact lumps near the top and of clay and of concretionary character below. So far as could be judged from the walls of the old diggings, most of the ore occurs in the top 20 feet. The lump ore is aggregated in more or less distinct pods or bands, the contacts of which being probably cross sections of lenticular aggregates of ore. As usual with ore of this class, it occurs in irregular pockets, and excavation might continue for several days without encountering much ore.

Limonite at Shelby.—The limonite deposit at Shelby was the largest in the area, but as operations have been abandoned there it possesses now only a scientific and historic interest. Operations were begun in 1844 to 1846, and work was practically continuous until about 1830. The iron made here only acquired a high reputation. A rolling mill was completed in 1850, at which iron pellets were made for the Confederate Government. The Mervin was armored with these plates. The working at Shelby have been confined in an area of about 150 acres. The ore deposit occurs in and beneath a mound, the top of which was originally 100 feet above the surrounding surface. The external two-thirds of the ore-bearing area is underlain by Neosha limestone, and the western third possibly by shale. The limestone and shale being separated by a fault. The thickness of the deposit has never been determined, but it is known by test pits in the bottom of the deepest workings; to be more than 100 feet thick and to contain ore to the greatest depths explored. Probably the deposit accumulated in an old sink hole.

The ore was in two quite different kinds of material sharply separated from each other. Over most of the ore-bearing area was a layer of compact red No. 15 about 15 feet thick, called the "blanket." Underlying the "blanket" in most of the area was a heterogeneous mass of more or less iron-stained clay, sand, and rock fragments. (See pl. 13.) On the north side of the workings, and apparently only there, a white and orange-colored sand and clay between the "blanket" and the clay, as shown in the following section:

<table>
<thead>
<tr>
<th>Section at south edge of Shelby workings</th>
<th>Ft. in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loam, red, compact, with white cord and &quot;blanket&quot;</td>
<td>15</td>
</tr>
<tr>
<td>Silt, dark gray, with white cord and &quot;blanket&quot;</td>
<td>15</td>
</tr>
<tr>
<td>Sand, like ash, but orange-colored, with abundant quartz pebbles</td>
<td>15</td>
</tr>
<tr>
<td>Clay, tawny, with one powder and slates of slate ore, with chert (siliceous), probably residual from limestone</td>
<td>15</td>
</tr>
</tbody>
</table>

The red loam of the "blanket" resembles the red loam that has been called "Lafayette" in other parts of the State. The 12 ft. or so of sand and pebbles has the appearance of Cretaceous material and probably is such. The clay pit south of the workings encountered this sand and gravel. It was inappreciable to utilize the ore where the gravel and sand occur, on account of the difficulty of separating the pebbles. The clay pit, north of the workings, containing the gray sand and the deposit, appears to be residual from the underlying limestone and shale. In place it resembles limestone project up into the clay to a height of 25 feet or so. (See pl. 14.)

The ore in the "blanket" is designated lump ore. It was assayed either irregularly through the red loam or to some extent aggregated into richer bodies having the form of thin lenses. Generally it was in small piece 2 inches or less in diameter, and completely rounded. In 1842, according to report, to average 32 per cent of metallic iron and to yield a ton of ore to 5 or 4 cubic yards. All the ore in the underlying clayey material was of all forms occurring in nodules—small speckled lumps, shelly, wavy layers, and concretionary masses. Much of this ore contained more or less abundant inclusions of chert, clay, and sand. Some lumps were too sandy for use. All gradations occur, down to sandstone composed of deposited sand and fine chert fragments, originally occurring loose in the deposit, with just enough iron oxide for cement. According to a report of the former superintendent, W. H. Walker, the ore from the deposit averaged 43 per cent of iron, and the yield was a ton of ore to 10 cubic yards of material.

The following analysis, made in January, 1911, has been supplied by the company.

<table>
<thead>
<tr>
<th>Analysis of iron from Shelby ore</th>
<th>Bank</th>
<th>Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron (Fe)</td>
<td>54.50</td>
<td>55.00</td>
</tr>
<tr>
<td>Silica (SiO2)</td>
<td>34.90</td>
<td>34.90</td>
</tr>
<tr>
<td>Alumina (Al2O3)</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Phosphorus (P2O5)</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>Magnesia (MgO)</td>
<td>9.00</td>
<td>9.00</td>
</tr>
<tr>
<td>Sulfur (S)</td>
<td>0.09</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Some analyses show a somewhat higher percentage of iron and less silica and phosphorus than the brown ores of the Woodstock district, Rite County. The manganeses are about the same.

The charmer of the pig iron is shown by the analyses given in the next column.

<table>
<thead>
<tr>
<th>Analysis of iron</th>
<th>Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>FeO</td>
<td>12.65</td>
</tr>
<tr>
<td>Fe2O3</td>
<td>6.35</td>
</tr>
<tr>
<td>MnO</td>
<td>4.11</td>
</tr>
<tr>
<td>Al2O3</td>
<td>0.10</td>
</tr>
<tr>
<td>SiO2</td>
<td>66.35</td>
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The charmer of the pig iron is shown by the analyses given in the next column.
This dolomite underlies the low ground between the coal measures on the west side of the Trinity River (shallow east limb) east of Maybole. How much of this mass is of the grade shown by the analyses is unknown, since only 200 feet of core rock in the section studied. In the vicinity of Monte Carlo there are other bands of dolomite of the Kettone type discon­nected by fylls. The description of these bands is much nar­rower because they are thinner and the dip is steeper.

**Newala Limestone**—The Newala limestone is extensively exposed in Calera Creek and its tributaries. The Newala dolomite forms the upper part of the A section, the Scepawn, Longview, and Fort Payne series in this area. The limestone has a thickness of 15 feet and extends the full length of Calera Valley in this quadrangle. The quantity of the rock is therefore practically inexhaustible. The beds dip eastward, generally 30° to 40°, and crop out on the level valley floor. This attitude neces­sitates open-pit quarrying, the hoisting of the rock, and con­tinual pumping of water. Successful operations, therefore, demand a rather expensive equipment. Except for layers and thicker beds of dolomite here and there, assisted by adit cutting by the quarrymen (see analyses 4 and 5), the limestone is very porous. These beds of dolomite are an obstacle to quarrying when pure limestone is needed for dimension stone. The dolomite is not sharply separated, and a face of rock free from it is of sufficient height for economical quarrying seems hard if not impossible. In the following table are given analyses of the Newala limestone and of line made from it. The Key­stone quarry is in the Bessemer quadrangle; the other quarries are in the Monocline quadrangle.

### Analyses of Newala Limestone

<table>
<thead>
<tr>
<th>Analysis</th>
<th>$CaCO_3$ (%)</th>
<th>$Al_2O_3$ (%)</th>
<th>$SiO_2$ (%)</th>
<th>$Fe_2O_3$ (%)</th>
<th>$MgO$ (%)</th>
<th>$MnO$ (%)</th>
<th>$K_2O$ (%)</th>
<th>$Na_2O$ (%)</th>
<th>$CO_2$ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average sample</td>
<td>54.295</td>
<td>3.13</td>
<td>10.60</td>
<td>2.80</td>
<td>0.5</td>
<td>0.10</td>
<td>0.61</td>
<td>0.38</td>
<td>4.47</td>
</tr>
<tr>
<td>2. Pottsville Limestone Co., Longview, Ala. 5 Average samples: and 4. curve plotted rock.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Shady Limestone, Works, Bessemer, Ala. 3. monomineralic rock, and 4. curve plotted rock.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Cements and Shale**

- **Noncalcareous Ignimbrites**: The ignimbrites of Newala are coarse grained and are the cinders of eruptions of the Newala volcano. The Newala ignimbrites are characterized by their small and abundant crystals of quartz and feldspar, which are set in a fine-grained groundmass. The ignimbrites are typically red or brown in color and are commonly interbedded with tuff and ash layers. The Newala ignimbrites are found in the Newala quadrangle and are important as a source of construction and landscaping materials.

- **Dolomite**: The dolomite of the Newala formation is characterized by its high calcium carbonate content, typically greater than 90%. The Newala dolomite is a white to light gray rock and is commonly used as a building stone and in construction projects. The dolomite is found in the Newala quadrangle and is a significant resource for sustainable construction practices.

### Geologic Map

A map is provided showing the distribution and thickness of the Newala limestone and dolomite formations. The map highlights the areas of thick and thin deposits and provides a visual representation of the geologic structure of the region.

---

### Tables

#### Analyses of Newala Limestone

<table>
<thead>
<tr>
<th>Analysis</th>
<th>$CaCO_3$ (%)</th>
<th>$Al_2O_3$ (%)</th>
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<td>2. Pottsville Limestone Co., Longview, Ala. 5 Average samples: and 4. curve plotted rock.</td>
<td></td>
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<td>4. Shady Limestone, Works, Bessemer, Ala. 3. monomineralic rock, and 4. curve plotted rock.</td>
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### Conclusion

The Newala limestone and dolomite formations are significant geologic resources in the Newala quadrangle. The formations are characterized by their high calcium carbonate content and are important for construction and landscaping applications. The ignimbrites of the Newala formation are also significant, providing a valuable source of construction materials and aiding in sustainable building practices.
are an impediment to cultivation, but on the lower grounds the short fragments, though plentiful, are fine and less troublesome. The areas of Conemaugh limestone have a reddish, yellowish, or black clay loam of good fertility. The same statements apply to the Newala and Lenoir limestone areas of Calhoun Valley.

The areas of Floyd shale and Waxahatchee, Brewer, and Wash Creek slates are likely to have a clay soil, not thick except in places, and of fairly good quality, especially over the more indurated parts of the slates. This soil produces good crops of corn, cotton, and vegetables, and with intelligent treatment should hold its productivity well. The small species of Leptodon (Japan clover) and native grasses thrive fairly uniformly distributed throughout the year that the surface water supply is ample for all needs, including potable water, for stock, and for industrial establishments requiring large quantities, as for sawing trees, washing coal, or smelting.

Ground water.—There are many springs in the limestone belt and one, Bay Spring, 4 miles south of Shelby, has a flow sufficient to run a sawmill. This spring is probably the outlet of an underground steam. At Shelby Springs are a number of sulphur and chalybeate springs whose waters are supposed to have medicinal value, but no analyses of them are available. These are near the fault separating the Floyd shale and the Waxahatchee, Brewer, and Wash Creek slates. In general, however, outside the limestone areas, soil water is not available sufficient supplies of water can be had by sinking wells to a depth of 50 feet at most places in the Potsville and the Waxahatchee, Brewer, and Wash Creek areas and not more than 100 feet in the area of Conemaugh sand and gravel. The range in quality and composition of this water is shown in the accompanying table of analyses. The water from the limestone areas is hard, with a 34-foot dam and an 80 per cent turbine, 500 net horsepower at ordinary low water. In these quadrangles the flow of the Cahaba is smaller, but the potential power is still considerable. Coosa River is the largest stream traversing any part of the quadrangles, and its power is developed by the Alabama Power Co. with a dam and power plant about 12 miles south of the Columbiana quadrangle, the stock water extending into the quadrangle.

Within these quadrangles minor power could be utilized on Shoal, Mohan, Russelhatchee, Waxahatchee, and other creeks and on Cahaba and Little Cahaba Rivers. On Mahan Creek near Brierfield 35 horsepower has been developed at one mill and 60 horsepower at another. The flow from Bay Spring, about 21 miles south of Shelby, on the fault line between the Newala limestone and the Waxahatchee, Brewer, and Wash Creek slates, is sufficient to supply power for a gristmill and sawmill near the mouth of Mill Creek.

### Water Resources

**Surface Water**

- **Spring water**—The average annual precipitation in these quadrangles ranges from 48 inches in the southern part to 50 inches in the northern part. This precipitation is usually so uniformly distributed throughout the year that the surface water supply is ample for all needs, including potable water, for stock, and for industrial establishments requiring large quantities, as for sawing trees, washing coal, or smelting.

**Ground water**—These are near the fault separating the Floyd shale and the Waxahatchee, Brewer, and Wash Creek slates. In general, however, outside the limestone areas, soil water is not available sufficient supplies of water can be had by sinking wells to a depth of 50 feet at most places in the Potsville and the Waxahatchee, Brewer, and Wash Creek areas and not more than 100 feet in the area of Conemaugh sand and gravel. The range in quality and composition of this water is shown in the accompanying table of analyses. The water from the limestone areas is hard, as shown by samples 42 to 44. The water from the Cretaceous, being from sand and gravel, is remarkably free from lime and consequently of very low hardness.

Little is known regarding the deep waters of these quadrangles. The Shales and Pine sandstones seem to be good water-bearing strata, and flowing wells might be obtained by drilling to them in the Bella Ellen syncline and possibly also in the Yellow Leaf syncline. Elsewhere the structural conditions do not appear to be favorable for artesian wells.

**Water power**—No regular gaging stations have been maintained on streams in the Montevallo and Columbiana quadrangles, and no miscellaneous discharge measurements have been made.

Cahaba River and the larger creeks are capable of developing considerable power for gristmills, sawmills, small electric plants, and other industrial works. Cahaba River near Euton, several miles west of this region, is capable of developing, with a 34-foot dam and an 80 per cent turbine, 500 net horsepower at ordinary low water. In these quadrangles the flow of the Cahaba is smaller, but the potential power is still considerable. Coosa River is the largest stream traversing any part of the quadrangles, and its power is developed by the Alabama Power Co. with a dam and power plant about 12 miles south of the Columbiana quadrangle, the stock water extending into the quadrangle.

Within these quadrangles minor power could be utilized on Shoal, Mohan, Russelhatchee, Waxahatchee, and other creeks and on Cahaba and Little Cahaba Rivers. On Mahan Creek near Brierfield 35 horsepower has been developed at one mill and 60 horsepower at another. The flow from Bay Spring, about 21 miles south of Shelby, on the fault line between the Newala limestone and the Waxahatchee, Brewer, and Wash Creek slates, is sufficient to supply power for a gristmill and sawmill near the mouth of Mill Creek.

### Approximate Analyses of Waters of the Montevallo and Columbiana Quadrangles, Ala.

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<th>No.</th>
<th>Description of sample</th>
<th>Date of Collection</th>
<th>Formations</th>
<th>Total Solids</th>
<th>Chlorides</th>
<th>Sodiuim</th>
<th>Potassium</th>
<th>Calcium</th>
<th>Magnesium</th>
<th>Sodium</th>
<th>Carbonate</th>
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August, 1924.