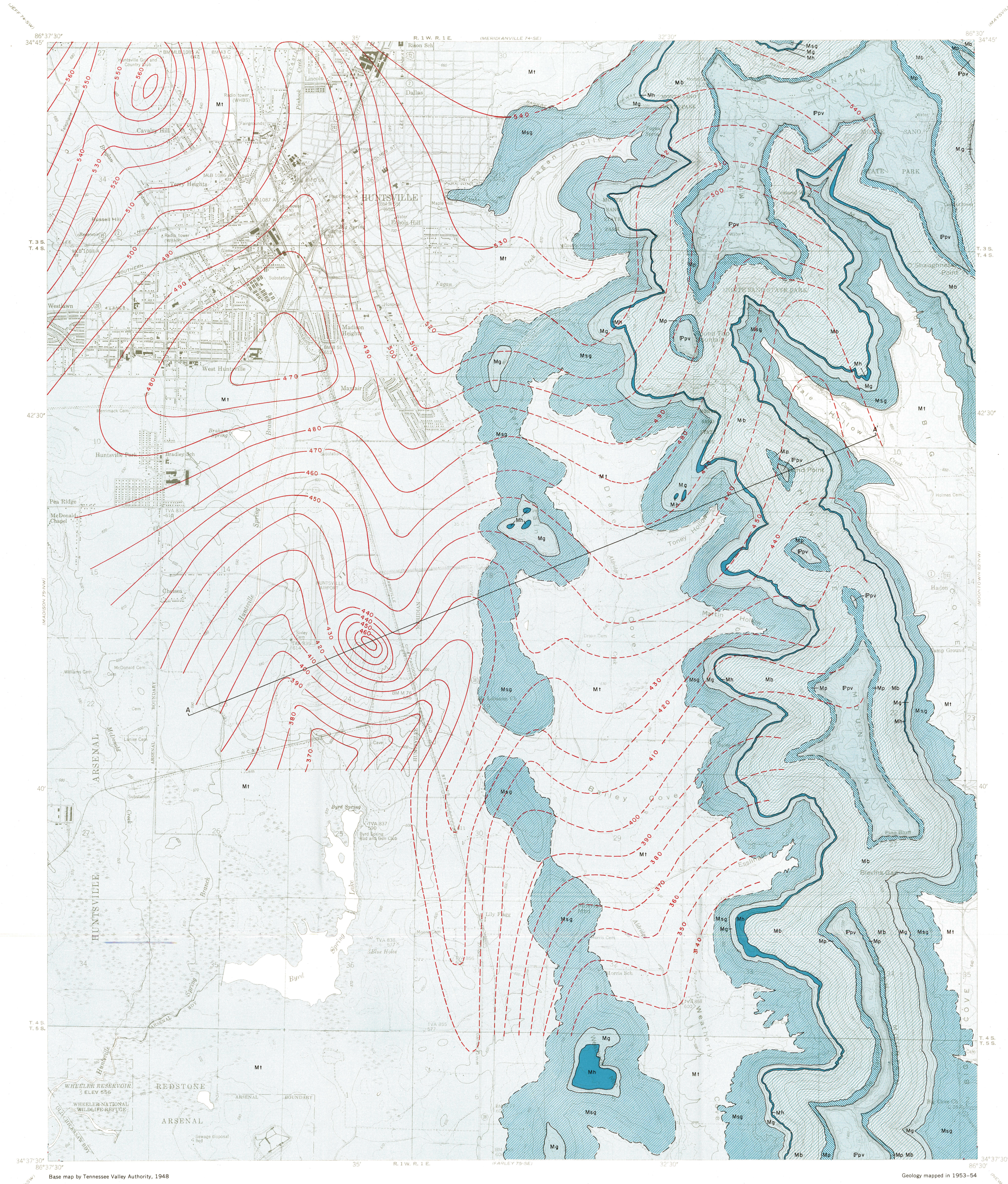


Base map by Tennessee Valley Authority, 1948

Geology mapped in 1953–54

EXPLANATION

Pennsylvanian (Carboniferous)

Ppv — Pottsville formation
Sandstone, brown and gray-brown, medium- to coarse-grained, massive and thin bedded, some shale and a coal bed near the base of the formation

Mississippian (Carboniferous)

Mp — Pennington formation
Shale, red, gray and green, sandy with a few shaly limestone beds

Mb — Bangor limestone
Limestone, blue-gray, massive, crystalline, oolitic, and in part fossiliferous; some dolomitic limestone layers and shaly beds in upper part

Mh — Hartselle sandstone
Sandstone, tan to brownish-gray, medium- to coarse-grained, hard, locally contains beds of green shale and limestone

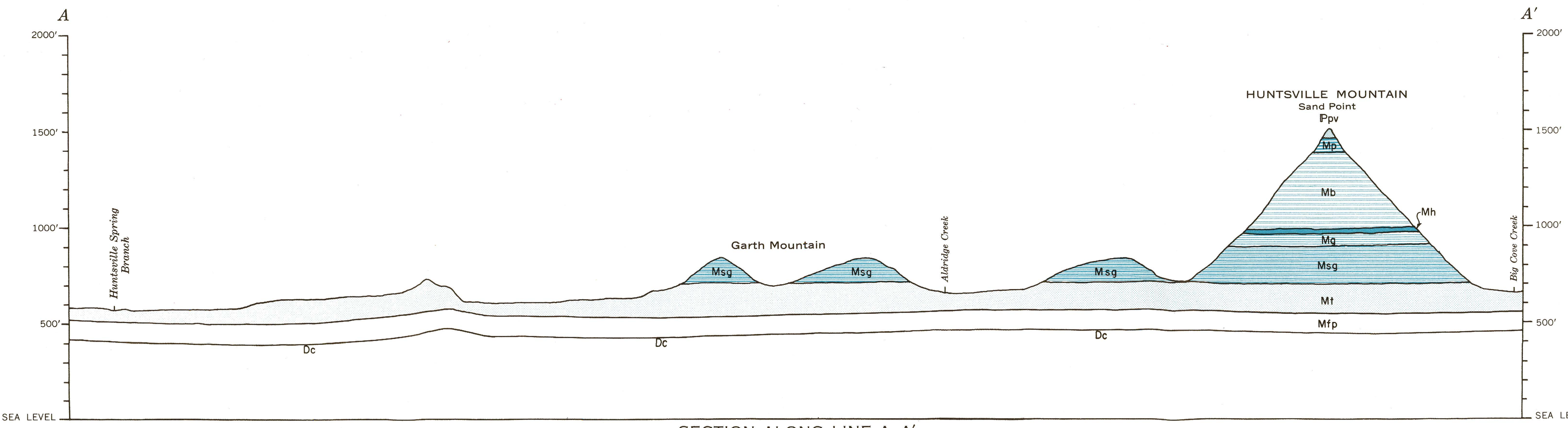
Mg — Gasper formation
Limestone, light-gray to gray, argillaceous, crystalline, abundantly fossiliferous, oolitic in part, some shaly zones

Msg — Ste. Genevieve limestone
Limestone, light-gray, oolitic, thick-bedded fossiliferous

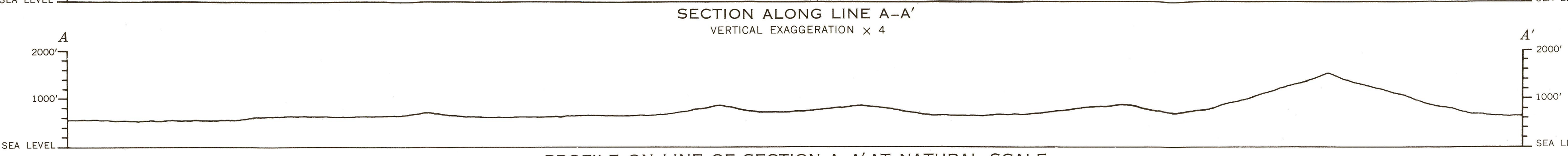
Mt — Tuscumbia limestone
Limestone, dark- to light-gray crystalline, massive-bedded, fossiliferous with some cherty layers

Contact
Dashed where inferred

500 — Structure contour projected from the base of the Fort Payne chert
Dashed where approximately located; contour interval 10 feet



SECTION ALONG LINE A–A′
VERTICAL EXAGGERATION × 4



PROFILE ON LINE OF SECTION A–A′ AT NATURAL SCALE

GENERALIZED COLUMNAR SECTION

System		Age	Formation	Symbol	Lithology	Thickness in feet	Character of rocks
Carboniferous	Pennsylvanian		POTTSVILLE FORMATION	Ppv		85±	Sandstone, brown and gray-brown, medium- to coarse-grained, crossbedded, massive and thin-bedded; Coal bed; Shale, brown to red, fissile; Shale, sandy, light-tan
Carboniferous	Mississippian	Chester	PENNINGTON FORMATION	Mp		80–100	Shale, sandy, brown to purple, fossiliferous; Limestone, light-gray, crystalline, massive; Shale, red and green; Shale, red and green, interbedded light-gray siliceous limestone
Carboniferous	Mississippian	Chester	BANGOR LIMESTONE	Mb		350–420	Limestone, blue-gray and light-gray to tan, massive to thin-bedded, crystalline, oolitic, argillaceous, shaly; green to gray calcareous, fossiliferous shale; light-gray and tan dolomite with black chert
Carboniferous	Mississippian	Chester	HARTSELLE SANDSTONE	Mh		0–60	Sandstone, gray to tan, fine-grained, crossbedded, fossiliferous
Carboniferous	Mississippian	Chester	GASPER FORMATION	Mg		40–90	Limestone, light-gray to gray, argillaceous, crystalline, oolitic, abundantly fossiliferous; green fossiliferous shale
Carboniferous	Mississippian	Meremac	STE. GENEVIEVE LIMESTONE	Msg		180±	Limestone, light-gray, oolitic, crystalline, thin-bedded to massive fossiliferous; olive-green calcareous shale
Carboniferous	Mississippian	Meremac	TUSCUMBIA LIMESTONE	Mt		150–200	Limestone, dark- to light-gray, massive fossiliferous; some cherty layers
Carboniferous	Mississippian	Osage	FORT PAYNE CHERT	Mfp		95–120	Limestone, gray to yellow, massive, crystalline, fossiliferous; abundant blue-gray chert
Devonian			CHATTANOOGA SHALE	Dc		1–15	Shale, black, fissile, carbonaceous, pyritic; some sandstone

EXPLANATION

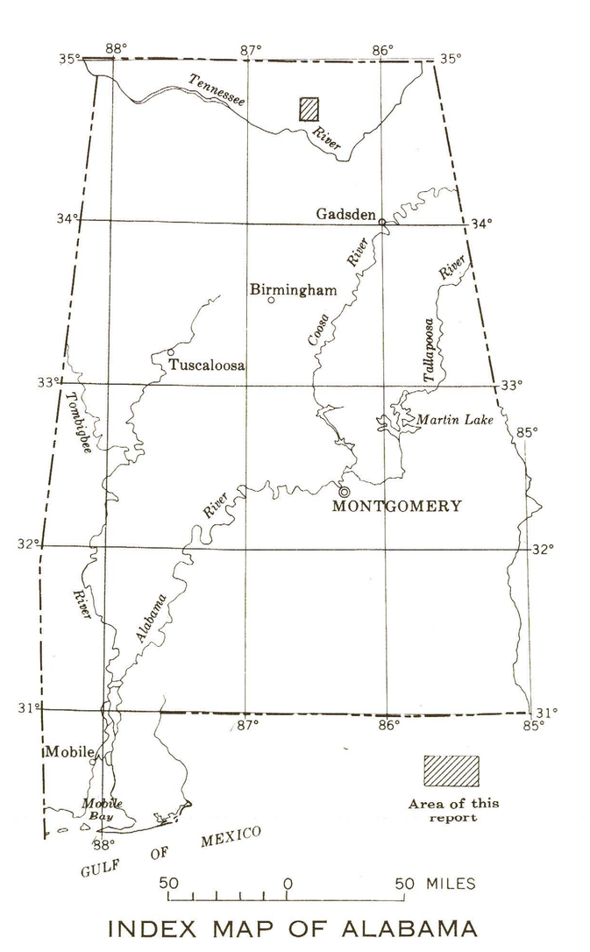
Massive sandstone · Bedded sandstone · Crossbedded sandstone · Calcareous sandstone · Massively bedded limestone · Thin-bedded limestone · Limestone containing nodules of chert or flint · Dolomite · Crystalline limestone · Argillaceous limestone · Sandy shale · Shaly limestone · Shale · Coal · Carbonaceous shale · Fossiliferous

FEET 0 — 50 — 100 — 150

INTRODUCTION

The 7½-minute Huntsville quadrangle is in south-central Madison County, Ala., and includes part of the city of Huntsville. The south, north, east, and west boundaries of the quadrangle are about 3 miles north of the Tennessee River, 15½ miles south of the Tennessee line, 8 miles west of the Jackson County line, and 9 miles east of the Limestone County line.

The bedrock geology of the Huntsville quadrangle was mapped by the U. S. Geological Survey in cooperation with the city of Huntsville and the Geological Survey of Alabama as part of a detailed study of the geology and ground-water resources of Madison County, with special reference to the Huntsville area. G. T. Malmberg began the geologic mapping of the county in July 1953, and completed it in April 1954. T. H. Sanford, Jr., assisted Malmberg in the final phases of the county mapping, which included measuring geologic sections with hand level and steel tape. In November 1958 Sanford, assisted by L. R. West, checked contacts and elevations in the Huntsville quadrangle; made revisions in the contact lines; and wrote the text for this report. The fieldwork for this report was completed in April 1959.



INDEX MAP OF ALABAMA

PHYSICAL GEOGRAPHY

The Huntsville quadrangle includes parts of two physiographic provinces of the eastern United States: the Highland Rim section of the Interior Low Plateau in the western part of the quadrangle and the Cumberland Plateau section of the Appalachian Plateaus in the eastern part (Fenneman, 1938). The western margin of the Cumberland Plateau is marked by discontinuous west-facing escarpments. Dissection of the margin of the Cumberland Plateau has reached an advanced stage, and the resulting broad valleys grade westward into the rolling lowlands of the Highland Rim. Monte Sano, an escarpment of the Cumberland Plateau, rises in the quadrangle more than 1,000 feet above the lowlands of the Highland Rim section. The lowest point in the quadrangle is in the southwest corner along Huntsville Spring Branch, which is 560 feet above mean sea level, and the highest point is in the northeast corner on Monte Sano, which is 1,640 feet above mean sea level.

Highland Rim section.—In the Highland Rim section the limestone bedrock is mantled by thick red residual soil. Exposures of the limestone are relatively sparse in the valleys because of the thick soil. Exposures occur mainly in road cuts on the hills where the soil is relatively thin. Most of the Highland Rim section within the quadrangle is in the Huntsville city limits; and, although the area is still sparsely populated, it is rapidly being developed for commercial and residential uses. Some parts of the Highland Rim section, such as the area around Byrd Spring and the large swampy area to the south, are too low and too poorly drained to be of importance for real-estate developments. These areas, outside the city boundaries, are used by a rod and gun club. The remaining area in the Highland Rim section is within the Redstone Arsenal. Much of this area is leased to farmers for pasture land, and the remainder is low swampy land which includes part of the Wheeler National Wildlife Refuge. This area is also characterized by depressions in the land surface caused by subsidence in the underlying cavernous limestone.

The area occupied by Garth and Weatherly Mountains and the valley formed by Drake, Bailey, and Weatherly Coves may be considered transitional between the Highland Rim and the Cumberland Plateau. This area, of which part is included in the city of Huntsville, is rapidly developing as residential and commerical property because the hills, although densely wooded, are considered ideal for suburban development.

Cumberland Plateau.—The Cumberland Plateau has much greater relief than the Highland Rim. Hills rising to as much as 1,600 feet above sea level mark the western margin of the Cumberland Plateau. The tablelike hilltops and rugged slopes leading up to them are heavily wooded with red cedar, yellow pine, and hardwoods.

Drainage.—The Huntsville quadrangle is drained by Huntsville Spring Branch and its tributaries and by Aldridge Creek, all of which flow southward to the Tennessee River. Most of the streams are perennial, being fed by springs and seepage from perched water bodies. Perennial springs in the Highland Rim section include Huntsville Spring, Brahan Spring, and Byrd Spring. Huntsville Spring Branch and its main tributary Pinhook Creek are dredged periodically to prevent flooding during periods of intensive rainfall. Huntsville Spring Branch south of Huntsville airport meanders where dredging has not been done. The area in the southwestern part of the quadrangle in the vicinity of Byrd Spring Lake is swampy because of poor drainage and a shallow water table.

STRATIGRAPHY

The consolidated rocks that crop out in the Huntsville quadrangle are of marine sedimentary origin and are Mississippian and Pennsylvanian in age. The unconsolidated deposits in the valleys are almost entirely residual. The rocks below the surface, studied from extensive test drilling, include some Mississippian and Devonian age. However, one deep oil-test well drilled in the quadrangle, the New York-Alabama Co. West Huntsville No. 2 (Bowles, 1941, p. 12), in the SE¼ sec. 3, T. 4 S., R. 1 W., at a depth of 2,542 feet bottomed in Ordovician rocks.

The Devonian rocks consist of carbonaceous shale and sandstone assigned to the Chattanooga shale. The Mississippian rocks consist of limestone, chert, dolomite, shale, and sandstone and are subdivided into the Fort Payne chert, Tuscumbia limestone, Ste. Genevieve limestone, Gasper formation, Hartselle sandstone, Bangor limestone, and Pennington formation. The Pennsylvanian rocks consist of sandstone, shale, and coal, which are assigned to the Pottsville formation. The unconsolidated deposits consist of clay, chert gravel, and boulders.

CHATTANOOGA SHALE

The Chattanooga shale, of Late Devonian age, does not crop out in the Huntsville quadrangle but can be identified in samples collected from 45 wells drilled in the quadrangle. The formation ranges in thickness from 1 to 15 feet and consists of a dense black highly fissile shale that contains pyrite and, at some locations, a white to gray sandstone. The formation, as penetrated in a test well drilled in sec. 2, T. 4 S., R. 1 W., consisted of black siliceous, very pyritiferous shale containing numerous spores and conodonts, and of sandstone composed of rounded vitreous quartz sand grains. The thickness was 5 feet.

The Chattanooga shale rests unconformably on the Red Mountain formation of Silurian age in north-central Madison County, north and northeast of the Huntsville quadrangle, and on the Chickamauga limestone of Ordovician age in the northwestern part of the county. The limestone, chert, and shale underlying the Chattanooga shale in the subsurface of the Huntsville quadrangle are assigned to the Red Mountain formation.

The fossils in the Chattanooga shale include many species of conodonts (Adams and others, 1926, p. 158–161).

FORT PAYNE CHERT

The Fort Payne chert, of Early Mississippian age, does not crop out in the Huntsville quadrangle but, like the Chattanooga, can be identified in well samples collected in the quadrangle. The formation ranges in thickness from about 95 to 120 feet and consists of light-gray or white to green siliceous limestone and irregular zones of white to dark-gray chert. Thin beds of gray and green shale are intercalated with the beds of siliceous limestone. The basal 5 to 6 feet of the formation consists mainly of green limestone and shale.

The Fort Payne chert lies unconformably on the Chattanooga shale. The unconformable contact between the green shale at the base of the Fort Payne chert and the underlying black Chattanooga shale is very distinct. Structure contours shown on the geologic map are based on the configuration of this contact.

The Fort Payne chert contains many fractures and solution channels. A well drilled in the NW¼SE¼ sec. 25, T. 3 S., R. 1 W. intersected the top of a solution channel 14.5 feet deep at a depth of 87.5 feet below the land surface. The bottom of this channel is about 15 feet above the contact of the Fort Payne chert with the Chattanooga shale. This channel is part of a vast system of interconnected solution openings in the Fort Payne chert.

The formation is very fossiliferous and contains an abundance of crinoid stems and plates. The crinoid remnants are especially abundant near weathered zones and in solution cavities.

The Fort Payne chert conformably underlies the Tuscumbia limestone; the contact is indistinct and difficult to recognize, particularly in the subsurface.

TUSCUMBIA LIMESTONE

In the Huntsville quadrangle the Tuscumbia limestone is about 150 to 200 feet thick, as determined from test drilling. The formation crops out in the Highland Rim section of the quadrangle, in the valley east of Garth and Weatherly Mountains, and in Big Cove. Areas of outcrop are characterized by broad, gently rolling hills that are mantled by dark-red residual soil. The formation consists of thin-bedded to massive dark- to light-gray fine to coarsely crystalline very fossiliferous limestone, and small amounts of gray to white chert in irregular layers and nodules. Upon weathering, however, much secondary chert is formed by the replacement of calcium carbonate by silica, and areas underlain by the Tuscumbia limestone are thickly strewn with cherty rubble. The cherty rubble occurs as rectangular blocks as much as 12 inches square and 5 to 6 inches thick. The chert in these blocks is commonly porous and opaque and breaks down readily into small rectangular pieces, the fresh surfaces of which are generally covered with a powdery material resembling tripolite.

On the basis of fossils the Tuscumbia limestone of northern Alabama has been divided (Adams and others, 1926, p. 167) into two units, the Warsaw limestone below and the St. Louis limestone above. In this investigation, the Tuscumbia limestone is mapped as one unit of Warsaw and St. Louis ages. The Tuscumbia limestone underlies the Ste. Genevieve limestone of Late Mississippian age and has been described (Adams and others, 1926, p. 177) as being separated from the Ste. Genevieve by a slight unconformity. This unconformity, however, is not readily apparent in the Huntsville quadrangle.

Fossils are very abundant throughout the formation. Common among these are crinoid plates, bryozoan fragments, corals, and brachiopods. Bryozoa and crinoid stems are especially abundant in the massive limestone beds in the lower part of the formation. Many of the chert boulders that litter the outcrop areas are mainly composed of casts of small crinoid stems and Bryozoa. The upper part of the formation contains many compound lithostrotionoid corals. Characteristic fossils of the formation include *Fenestella tenax* Ulrich, *F. serratula* Ulrich, *Polypora varsoviensis* Prout, *Spirifer bifurcatus* Hall, *S. lateralis* Hall, *Torynifer salemensis* (Weller), *Hapsiphyllum calcariforme* (Hall), and lithostrotionoid corals—species of *Lithostrotionella*, *Dorlodotia*, and *Lithostrotion*—widely referred to in the older literature as *Lithostrotion canadense* Castelnau and *L. proliferum* Hall.

The Tuscumbia limestone contains an extensive network of solution cavities that developed along fractures in the limestone. In places, large springs occur where water-bearing solution channels intersect the land surface. Big Spring in Huntsville issues from a tubular opening at the foot of a cliff of the Tuscumbia limestone. The channel from which the spring flows is described (Johnston, 1933, p. 44–45, 271–272) as part of a complex network of interconnected solution channels. The city of Huntsville is underlain by this system of channels. Other large springs flowing from the Tuscumbia limestone include Brahan Spring and Byrd Spring.

STE. GENEVIEVE LIMESTONE

The Ste. Genevieve limestone crops out on the lower slopes of the mountains and forms the outlying hills of the dissected part of the Cumberland Plateau. Good exposures are present on Monte Sano, where the formation was found to be 190 feet thick in a section measured along U. S. Highway 431 on the west slope. The Ste. Genevieve is a massively bedded light-gray oolitic limestone. Weathered exposures are nearly white and have smooth, well-rounded surfaces. Near the top of the formation the thin beds of limestone are separated by beds of shale that range in thickness from 2 inches to 5 feet. On weathering, the Ste. Genevieve yields pink and gray chert containing spherical nodules. These nodules often retain the original oolitic texture common to the formation. The chert nodules in the Ste. Genevieve limestone are readily discernible from the more blocky chert of the underlying formations.

The Ste. Genevieve overlies the Tuscumbia limestone and is overlain by the Gasper formation. The contact between the Ste. Genevieve and Tuscumbia limestones is well exposed in a road cut along the Bankhead Parkway on the west slope of Monte Sano and in limestone quarries in the southwest quarters of secs. 31 and 32, T. 3 S., R. 1 E. Exposures of the contact are poor along the base of Garth and Weatherly Mountains, along the southwest slope of Monte Sano, and along the west slopes of Huntsville and Green Mountains because of residual material and gentle slopes.

The Ste. Genevieve is very fossiliferous and contains the diagnositc crinoid *Platycrinus huntsvillae* Troost (= *P. penicillus* Meek and Worthen). The elliptically shaped spiny plates and twisted stems of these fossils can generally be found on weathered surfaces of the massively bedded limestone and in the shale partings. Other fossils include *Cystelasma quinqueseptatum* Ulrich, *Echinoconchus genevievensis* Weller, and numerous species of *Pentremites*.

GASPER FORMATION

The Gasper formation crops out on the slopes of Monte Sano and Huntsville and Green Mountains, and as outliers on Garth and Weatherly Mountains. The formation is about 90 feet thick in a road cut along U. S. Highway 431 on the slope of Monte Sano east of Huntsville, but thins southward to about 50 feet on the west slope of Green Mountain near the south edge of the quadrangle. The Gasper formation in the Huntsville quadrangle is composed of thin to massive beds of light-gray coarsely crystalline limestone. The base of the formation is generally thin-bedded argillaceous limestone and shale that weathers to flaggy rubble. The upper part of the formation consists of light-gray thick-bedded to massive oolitic limestone interbedded with crystalline limestone. Thin partings of blue-gray to yellow calcareous shale also are present. The Gasper formation contains an abundance of well-preserved fossils.

In its type locality in Warren County, Ky., the Gasper formation lies conformably on the Bethel sandstone. In the Huntsville quadrangle the Bethel sandstone is absent, and the Gasper lies unconformably on the Ste. Genevieve limestone. The contact between the Ste. Genevieve and the Gasper is well exposed in a road cut along U. S. Highway 431 on the west slope of Monte Sano. The contact is at the bottom of a dark-gray medium-bedded coarsely crystalline limestone, and at the top of a bed of blue-gray to green calcareous shale 6 feet thick. The contact of the Gasper formation with the underlying Ste. Genevieve limestone is commonly difficult to distinguish. The Gasper formation is overlain by the Hartselle sandstone in the Huntsville quadrangle.

The Gasper formation is abundantly fossiliferous and well-preserved fossils commonly weather out of the shaly parts of the formation. Guide fossils include the compound coral *Caninia veryi* (Green) (= *Campophyllum gasperense* Butts), *Agassizocrinus conicus* Owen and Shumard, *Pentremites godoni* (Defrance), *P. pyriformis* Say, *Chonetes chesterensis* Weller, and *Talarocrinus symmetricus* (Lyon and Casseday).

HARTSELLE SANDSTONE

The Hartselle sandstone is a distinct and mappable unit and is an important stratigraphic marker, even though it is decidedly lenticular in the Huntsville quadrangle and in other parts of Madison County. This formation is exposed in ledges on the slopes of the mountains and forms the cap rock on Weatherly Mountain. Outcrops less than 500 feet wide encircle the mountains and appear on the geologic map as narrow bands. The Hartselle was not mapped on the southeast slope of Huntsville Mountain nor along the east slope of Green Mountain because the outcrops are covered by residual soil and talus. However, the authors believe that the Hartselle is present in these areas (although it may be very thin) because of the prominent ledge formed between the outcropping Gasper formation and the Bangor limestone. The Hartselle sandstone is about 60 feet thick on the northwest slope of Green Mountain but is only 8 feet thick along U. S. Highway 431 on the west slope of Monte Sano. It consists of medium- to coarse-grained crossbedded brownish-gray to tan well-cemented sandstone. Along Bankhead Parkway on the northwest slope of Monte Sano it is 16 feet thick and consists of a series of shales, sandstones, and limestones and a basal unit of green very fossiliferous shale. The basal unit of green shale has been observed in some areas either with or without the overlying sandstone members.

The Hartselle sandstone in the Huntsville quadrangle is overlain by the Bangor limestone and lies unconformably on the Gasper formation. In Alabama it occupies the same stratigrapic position as does the Hardinsburg sandstone of the standard Mississippian section in Illinois and Kentucky (Adams and others, 1926, p. 195).

Although the formation is generally unfossiliferous, the argillaceous limestone beds and green shales contain an abundance of fossils which include *Chonetes chesterensis* Weller, *Amplexi-Zaphrentis spinulosa* (Milne, Edwards, and Haime), and *Archimedes swallovanus* Hall.

BANGOR LIMESTONE

Outcrops of the Bangor limestone are found on the upper slopes of and in the gaps on Monte Sano and Huntsville and Green Mountains. The Bangor ranges in thickness from about 350 to 420 feet and consists predominantly of massive beds of dark-gray crystalline and oolitic limestone and a few beds of shale, dolomite, and lithographic limestone. The basal part of the Bangor is generally medium to massively bedded argillaceous crystalline limestone that contains a few partings of yellow calcareous shale and is abundantly fossiliferous. The upper 70 feet of the Bangor is composed of interbedded green to gray calcareous shale and thin beds of dolomite and limestone. The formation is well exposed in road cuts along U. S. Highway 431 and the Monte Sano State Park road, where it has a measured thickness of 410 feet.

The Bangor limestone in the Huntsville quadrangle overlies the Hartselle sandstone and underlies the Pennington formation. Where the Hartselle is missing, the Bangor lies unconformably on the Gasper formation. The contact between the Bangor limestone and the Hartselle sandstone is exposed in a road cut along U. S. Highway 431 where medium-bedded dark-gray crystalline limestone of the Bangor overlies crossbedded gray to tan fine-grained sandstone of the Hartselle. In the area where the Hartselle is not present the unconformable contact between the Bangor and the underlying Gasper formation was indistinguishable because it is covered with talus. Also, the limestone near the top of the Gasper and the limestone near the base of the Bangor are similar lithologically.

The argillaceous limestone and shale in the lower part of the Bangor are very fossiliferous. Thin layers of limestone commonly contain an abundance of *Fenestella*. Bryozoans and brachiopods are the most abundant fossils. Some of the species of Bryozoa occur also in the Tuscumbia limestone, but they are more characteristic of the Bangor limestone. *Archimedes*, which is scarce in the Gasper formation and Ste. Genevieve limestone, is one of the common fossils of the Bangor. Other diagnostic fossils include *Prismopora serrulata* Ulrich, *Pentremites pyramidatus* Ulrich, *P. abbreviatus* Hambach (= *P. brevis* Ulrich), *Spirifer increbescens* Hall, and *Composita subquadrata* (Hall).

Extensive solution channels have developed in the Bangor limestone. The natural well on top of Monte Sano, in the NW¼SE¼ sec. 33, T. 3 S., R. 1 E., is a vertical solution cavity that developed along a system of vertical joints in the limestone. The cavity extends to a depth of more than 350 feet below the land surface, and it has been described in detail by Johnston (1933, p. 53).

PENNINGTON FORMATION

The Pennington is the uppermost formation of Mississippian age in the quadrangle. The formation crops out near the crests of the mountains, where it is protected by the overlying Pottsville formation. In bands less than 100 feet wide, it extends around the outlying remnants of the Cumberland Plateau. Areas of outcrop are characterized by steep bluffs that are generally mantled with sandstone debris from the overlying Pottsville formation. Good exposures are restricted to road cuts.

The formation is composed of about 80 to 100 feet of red, green, and gray sandy shale interbedded with thin layers of limestone. A massive bed of hard fossiliferous light-gray crystalline limestone about 20 feet thick occurs near the top of the formation. The shale beds weather readily to red or gray clay but are relatively resistant to erosion, and commonly form bluffs that protrude through the mantle of sandstone boulders. The complete thickness of the Pennington formation is exposed in a cut in the road leading to Monte Sano State Park, three-quarters of a mile north of the intersection with U. S. Highway 431.

In the Huntsville quadrangle the Pennington formation overlies the Bangor limestone and underlies the Pottsville formation of Pennsylvanian age. The contact of the Pennington formation with the underlying Bangor limestone is generally difficult to locate because it is usually covered. A good exposure is found in a road cut on the Monte Sano State Park road, half a mile south of the WHBS-FM radio tower. The contact is between a 33-foot zone of interbedded green to red earthy shale and light-gray limestone of the Pennington formation and a thin- to medium-bedded gray to tan siliceous dolomitic limestone of the underlying Bangor limestone.

The Pennington formation is not abundantly fossiliferous, but the massive limestone beds near the top contain fragments of crinoids, echinoid spines, and unidentified species of *Pentremites*.

POTTSVILLE FORMATION

The Pottsville formation of Early Pennsylvanian age, the youngest formation of Paleozoic age in the Huntsville quadrangle, forms a cap rock on the thick sequence of underlying rocks of Mississippian age. Outcrops are restricted to the crests of outlying remnants of the Cumberland Plateau. They occur discontinuously along the east side of the quadrangle as cap rocks on Monte Sano and Green and Huntsville Mountains. The outcrops appear on the geologic map as irregular areas surrounded by bands of the underlying formations. Only the lower part of the Pottsville formation occurs in the Huntsville quadrangle. It consists of about 85 feet of brown and gray-brown sandstone, shale, and coal. The basal 25 feet of the formation is composed of tan, brown, and red sandy shale interbedded with sandstone containing limonitic concretions as much as a foot in diameter. A coal seam about 1½ feet thick overlies the basal shaly part of the formation. Thin to massive crossbedded quartzitic sandstone overlies the coal bed. The sandstone is mainly fine to coarse grained but is conglomeratic in the lower 20 feet. Fresh surfaces are usually white to buff but weather to red, pink, or brown.

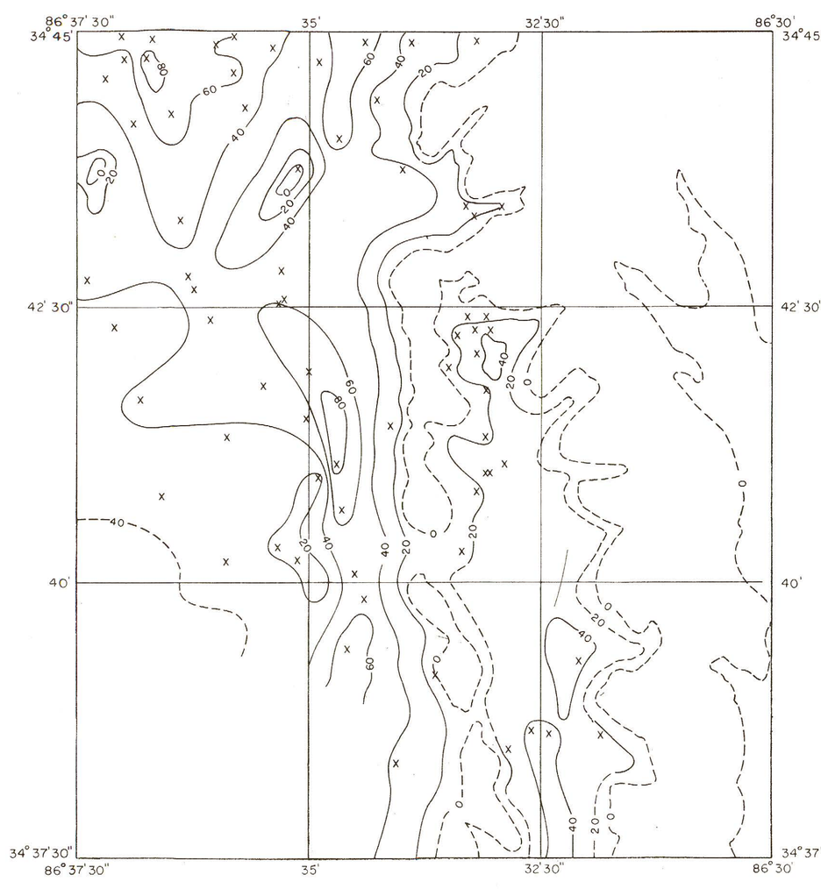
The Pottsville formation lies unconformably on shale of the Pennington formation and has been correlated by paleontologic and lithologic evidence (Adams and others, 1926, p. 215) with the lower part of the Pottsville formation of the type locality. The contact between the Pottsville and Pennington formations is generally obscured by detrital material from the Pottsville. A good exposure is found in a road cut a quarter of a mile south of the WHBS-FM radio tower on the Monte Sano State Park road, where the basal light-tan shaly part of the Pottsville formation lies unconformably on brownish-purple shale of the Pennington formation.

Although most of the Pottsville formation is not fossiliferous, a few thin shaly beds are. Representative fossils include *Derbyia crassa* (Meek and Hayden), *Dunbarella rectilaterarea* (Cox), *Aviculopecten occidentalis* (Shumard), and *Spirifer rockymontanus* Marcou. The principal types of fossil plants in the formation include species of *Calamites* and *Lepidodendron*.

SURFICIAL DEPOSITS

The surficial deposits consist of clay, sand, chert, and quartz gravel. In the Highland Rim section these deposits are almost entirely residual, being derived from the weathering of the underlying limestone. Alluvium fills parts of the stream valleys, and float and talus mantle the slopes of the hills and mountains.

In places the residual deposits consist of three distinct zones, which in descending order are (a) red clay, (b) yellow clay and chert gravel, and (c) chert gravel and boulders. The zone of red clay generally ranges in thickness from 10 to 30 feet and that of yellow clay and chert gravel from 0 to 40 feet, and that of chert gravel and boulders is as much as 5 feet thick. The zone of chert gravel and boulders, where it occurs below the water table, is an extensive aquifer that is much utilized as a source of domestic ground water. The upper two zones are generally impermeable, but at places perched water tables exist in sand lenses that probably were deposited in solution cavities in the parent limestone. Figure 1 shows the approximate thickness of unconsolidated material in the Huntsville quadrangle.



EXPLANATION

x — Thickness measured from land surface to top of bedrock

60 — Line of equal thickness
Dashed where estimated; isopach interval 20 feet

2 0 2 MILES

FIGURE 1.—MAP SHOWING APPROXIMATE THICKNESS OF UNCONSOLIDATED MATERIAL IN THE HUNTSVILLE QUADRANGLE, ALABAMA

The residual clay near the base of the mountains generally contains sand derived from the weathering of the sandstone capping the mountains. The slopes of the mountains are covered by float debris and talus.

The alluvium in the stream beds consists of thin beds of clay, sand, and chert and quartz gravel. A test well near an old stream bed in the SE¼ sec. 32, T. 4 S., R. 1 E., penetrated 2 feet of soil and 10 feet of alluvial sand and gravel before entering the limestone bedrock. A test well in the SE¼ sec. 23, T. 4 S., R. 1 W., penetrated 25 feet of soil and clay and 6 feet of sand and gravel above limestone bedrock. The alluvium was not mapped because detailed test boring would be necessary to delineate the deposits.

STRUCTURE

The Huntsville quadrangle lies partly in the Cumberland Plateau section of the Appalachian Plateaus and partly in the Highland Rim section of the Interior Low Plateau. The quadrangle lies west of the intensely folded and faulted Ridge and Valley province and south of the Nashville dome. The regional dip of the rocks, except for minor folds, is about 20 feet per mile toward the south-southeast. The structure contours shown on the geologic map are based on drill data and show the configuration of the contact between the Fort Payne chert and the Chattanooga shale. A northward-trending synclinal trough passes beneath the city of Huntsville. It is about 2 miles wide, and there is about 60 feet of relief between the lowest parts of the syncline and the higher areas along the east and west flanks.

ECONOMIC GEOLOGY

Ground water is used by the city of Huntsville for its water supply. The city has developed 4 wells and 1 spring that derive water from solution cavities in the Fort Payne chert and Tuscumbia limestone. Three of these wells and the spring are in the Huntsville quadrangle and the fourth well is a mile west of the quadrangle. The city pumps as much as 10 million gallons per day in the summer when demands on the water supply are greatest. Test drilling and pumping indicate that additional wells of large capacity can be developed in the limestone formations south of the city.

Limestone in the area is used extensively for road material and coarse aggregate. Quarries have been opened in the Tuscumbia and Ste. Genevieve limestones on the west slope of Monte Sano, but only one (in sec. 24, T. 4 S., R. 1 W.) is now operated in the Huntsville quadrangle.

Natural gas from wells in the Silurian rocks at depths of 278 and 300 feet supplied gas to Huntsville in 1907–08 (Semmes, 1929, p. 142). Gas and oil shows have been reported in many shallow water wells drilled in the quadrangle.

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INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—10285

GEOLOGY OF THE HUNTSVILLE QUADRANGLE, ALABAMA

By
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SCALE 1:24 000
1 MILE
CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT HALF-INTERVAL CONTOURS
DATUM IS MEAN SEA LEVEL

1961

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