GEOLOGICAL SURVEY OF GEORGIA

S. W. McCALLIE, State Geologist

BULLETIN NO. 42

PHYSICAL GEOGRAPHY

OF

GEORGIA

BY

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With an introduction

BY

S. W. McCALLIE, State Geologist

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LETTER OF TRANSMITTAL

GEOLOGICAL SURVEY OF GEORGIA,

ATLANTA, April 27, 1925.

To His Excellency, CLIFFORD M. WALKER, Governor and President of the Advisory Board of the Geological Survey of Georgia.

SIR: I have the honor to transmit herewith for publication a report on the Physical Geography of Georgia. This report, with the exception of the general introduction and the appendix, was prepared by the U. S. Geological Survey in fulfillment of an agreement for cooperation with the Geological Survey of Georgia, by which the former was to detail geologists from its staff and to pay their salaries while the work was in progress and the latter was to pay the field and traveling expenses (not exceeding $1000) and bear the cost of publication.

As but little printed information is available on the physical features of Georgia it is believed that this report will supply a very urgent need. The report will be of special value to the public school teachers in teaching the physical geography of Georgia. It will also be of value to the tourist and to the citizens and prospective citizens of the State who wish to familiarize themselves with the physical features of the different parts of Georgia.

Very respectfully,

S. W. MCCALLIE,

State Geologist.

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Photograph by J. K. Hillars.

TALLULAH FALLS.

PHYSICAL GEOGRAPHY OF GEORGIA

INTRODUCTION: THE STATE AS A WHOLE

By S. W. McCallie

LOCATION AND SIZE

The State of Georgia is the southernmost of the Atlantic Seaboard States, with the exception of Florida. Georgia is situated between the parallels 30° 21′ 20″ and 35° north latitude and the meridians 80° 50′ 24″ and 85° 36′ west of Greenwich. A belt of the earth's surface at this distance from the equator would traverse the following foreign countries: Morocco, Algiers, Tunis, Tripoli, North Egypt, Palestine, Arabia, Persia, parts of India and China, and southern Japan.

Georgia is bounded on the north by Tennessee and North Carolina, on the northeast by South Carolina and on the east by the Atlantic Ocean, on the south by Florida and on the west by Florida and Alabama.

The boundary line between Georgia and South Carolina is the eastern bank of Savannah River from its mouth to its junction with Tugaloo River and thence along the latter river to its junction with Tallulah River from which point it follows Chattooga River to the North Carolina line.

The northern boundary line of Georgia was intended to be at 35° of north latitude. It is in that position only at its east end and elsewhere is nearly one mile south of the latitude line.

The western boundary line begins at a cornerstone on the Tennessee State line marked on its south side "Geo. lat. 35° north; J. Camak." This stone stands near the top of Nickajack Mountain, one mile and twenty-eight rods from the south bank of Tennessee River and near the center of the old Indian town, Nickajack. From the Nickajack corner, above referred to, the State line between Georgia and Alabama runs south 9° 30′ east, approximately 146 miles to West Point (Millers Bend) on Chattahoochee River. Thence down the west bank of the Chattahoochee approximately 150 miles to its junction with Flint River, latitude 30° 42′ 42″, longitude 80° 53′ 15″.

The Southern boundary line beginning at the junction of Chattahoochee and Flint rivers runs S. 87° 17′ 22″ E., 158.35 miles to a point 37 links north of Ellicotts mound. Thence it follows the meanderings of St. Marys River to the Atlantic Ocean.

The shape of the state somewhat resembles that of an irregular keystone with its narrow end at the north. The five boundary lines

are all of different lengths, and no two of them are parallel. The greatest length of the State (approximately 320 miles) is from north to south and exceeds its greatest width from east to west by about 60 miles. A line drawn diagonally across the State from its northwest corner on the Tennessee line to the southeast at St. Marys on the Florida line, would have a length of about 400 miles, a distance nearly equal to that from Baltimore to Boston.

Georgia is the largest state east of the Mississippi River and ranks twentieth in size with those west of the Mississippi. Its area, 59,265 square miles, is only 7,159 square miles less than that of all the New England States combined. It is larger than England and Wales and more than one-fourth the size of France.

TOPOGRAPHY

Like most of the States of the Atlantic slope, Georgia does not have the same topographic character everywhere, but differs considerably in appearance in different portions. Some parts of the State are mountainous, some have a broadly rolling upland surface trenched by deep and narrow valleys, some are occupied by wide and rather flat-floored valleys, and some parts are nearly level plains. The portions of the State thus characterized by different sorts of topography are not scattered about haphazard, but are grouped in systematic fashion, so that the State as a whole can be divided into several portions—one dominantly mountainous, another chiefly rolling upland, etc., each of which has its own distinctive topographic character (see Pl. II).

That part of the State lying south of a line drawn from Augusta through Milledgeville and Macon to Columbus and comprising about three-fifths of the whole State, although hilly in some portions, is on the whole so flat or so gently rolling that it appears as a broad and somewhat uneven plain. This part is called the Coastal Plain. Near the coast it is low and very nearly level throughout broad areas, but farther inland its surface lies higher and is rolling or even hilly.

North of the Coastal Plain is a broad belt, extending across the State, which is dominantly a rolling upland. Much of its upland surface is nearly flat and appears from a commanding point as a somewhat uneven plain. This part is the Central Upland. Near the main streams its surface is cut by fairly deep valleys and here and there, especially in its northern portion, bold hills or small mountains stand well above the general level of the surface.

Most of the northwestern part of the State is occupied by a broad, relatively low-lying area called the Valley. It is really made up of several partly merging valleys with broad and generally flat or gently rolling floors. These valleys are partly separated by a number of mountain ranges, some of which are short, but others of which extend almost unbroken for many miles. In the extreme northwest corner of the State are two broad flat-topped ranges which are not like those in the Valley, but are parts of a plateau—the Lookout Plateau.

The northeastern portion of the State is dominantly mountainous and this part, called the Highland, is the highest and most rugged part

of the State and contains a number of peaks that stand more than 4,000 feet above sea level. It is not wholly mountainous, as small and rough-surfaced interior plateaus occupy part of the drainage basins of the rivers, but the mountains are the features that determine the general character of the region.

The topographic character of the several divisions of the State is treated in detail in subsequent chapters.

Explanation of topographic maps. In order that the surface features of a greater area than can be shown in a photograph might be brought before the eye, the descriptions of the topographic divisions of Georgia are illustrated by topographic maps of representative areas. Each map is copied from a larger map (about 15 × 17½ inches), in colors, made and for sale (price ten cents) by the United States Geological Survey, Washington, D. C.

The topographic maps of the U. S. Geological Survey show three kinds of features,—water, land, and works of man. The water features, shown in blue, include streams, ponds and lakes, and swamps; the shape of the land and its altitude above sea level are indicated by brown contour lines; the works of man, such as houses, roads, railroads, bridges, and boundary lines, are represented by suitable symbols in black. Some of the maps show woods or brush by green tints or symbols. The topographic maps in this book do not show the colors of the originals from which they were copied.

The contour lines on topographic maps represent imaginary level lines drawn at equal vertical distances apart on the surface of the earth. They are like furrows ploughed on the hillside, but instead of being spaced equally on the surface regardless of slope, each contour line is drawn at a definite height (usually 10, 20, 50 or 100 feet, called the *contour interval*) above or below the adjoining line. Where the slope is even, the contour lines are equal distances apart on the map, but they are close together on steep slopes and farther apart on gentle slopes. Like furrows, contour lines wind in and out of hollows and valleys and around the front of hills. Sinks and other depressions without surface outlets are represented by short lines projecting inward from the contour lines encircling them (see Plates XIII and XIV). The altitude above sea level of certain contour lines, usually every fifth line, is shown by figures. The altitude of intermediate lines can be ascertained by counting up or down from the nearest numbered line. The altitudes of many selected points, such as cross-roads and forks, is indicated by figures on the map.

CLIMATE [1]

The climate of any region is largely controlled by its latitude, its proximity to large bodies of water, and by its topographic features. Georgia lies in the warmer portion of the temperate zone; it touches the Atlantic Ocean, and its southwestern portion is separated from the Gulf of Mexico by only a narrow strip of land, consequently the southern half of the State has a very warm, moist climate. Over the northern half of the State, however, the physical features of the land, its

[1] Notes on climate furnished by C. F. Von Herrman U. S. Weather Bureau, Atlanta, Ga.

elevation into mountains attaining a maximum altitude of 4,768 feet, are the controlling factors. Mountains thrust themselves up into the cooler parts of the atmosphere, and their slopes give the winds a tendency to rise, causing abundant condensation and precipitation. The highest annual mean temperatures in Georgia are found in the extreme south, Quitman and Valdosta having an annual mean of 68°, but in northern Georgia, at elevations exceeding 2,000 feet, temperatures are more than ten degrees lower, Blue Ridge and Clayton having an annual mean of 57°. The increase in precipitation is also shown by the large annual rainfall at Dahlonega, 62 inches, and at Clayton and Rabun, 69 inches, as compared with amounts ranging from 45 to 53 inches in south-central Georgia.

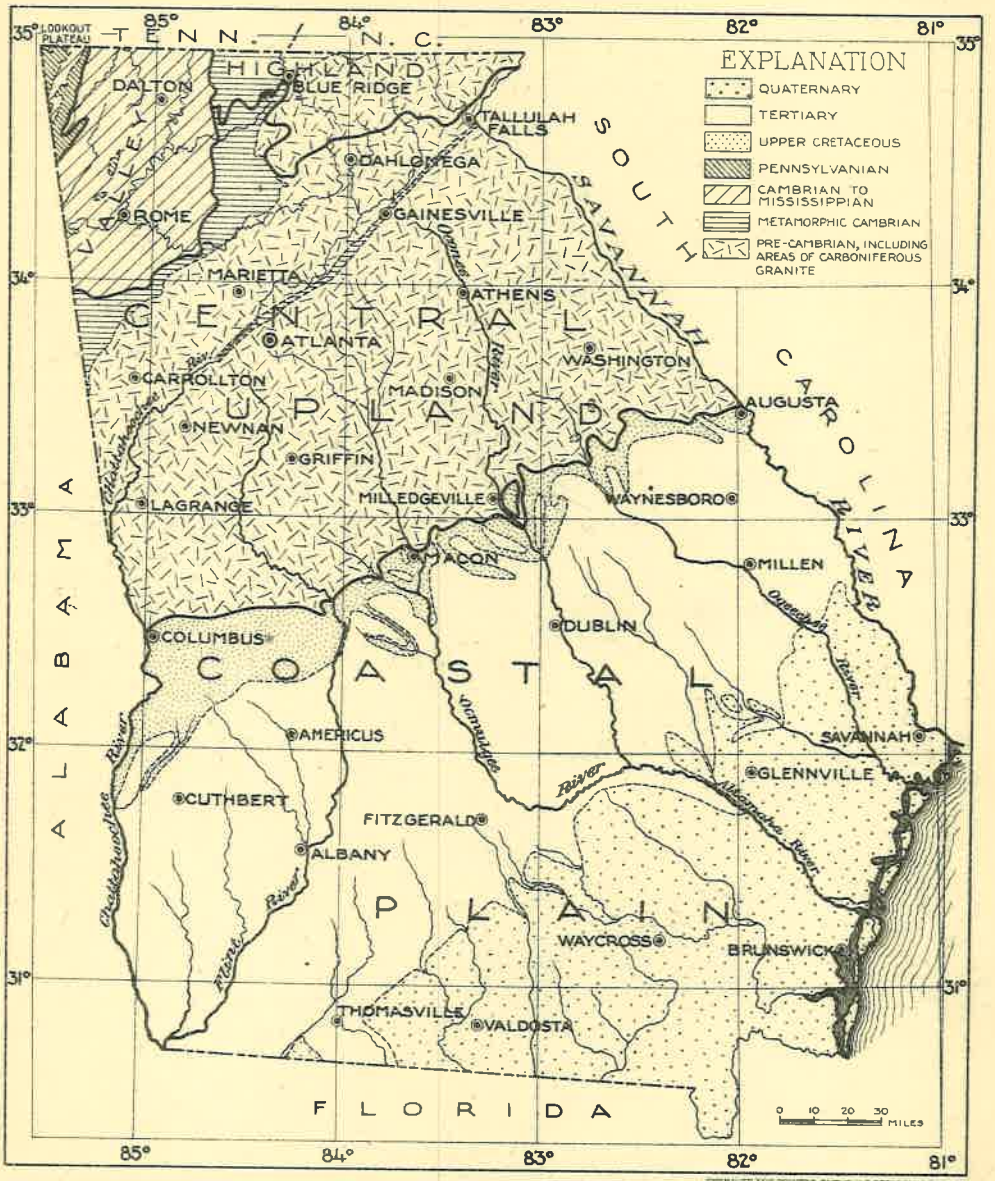
The climate of Georgia as a whole is characterized by long, relatively warm summers, during which the changes in temperature from day to day are small, and by short, mild winters. Southern and central Georgia are very warm; the July means range from 77° to 82° and the highest temperatures from May to October often exceed 100°. In the north the summers are much more moderate than might be expected. At Atlanta the maximum temperature has reached 100° but twice in 47 years. That the winters are usually mild throughout the entire State is sufficiently indicated by the fact that the monthly mean normal temperatures for January, the coldest month, do not fall below 40° even in the mountains. Nevertheless bracing cold waves occasionally occur and a rare intervals temperatures below zero are registered in Georgia. The annual mean temperatures of a few of the more important cities are as follows: Atlanta, 61°; Gainesville, 60°; Rome, 61°; Augusta, 64°; Macon, 64°; Savannah, 67°; and Brunswick, 68°.

The annual average number of clear days in Georgia is 165, and of rainy days 98. Abundant sunshine is the rule except during the winter rains which often cover the entire State. Throughout Georgia the length of the growing season—that is the interval between the dates of the last killing frost in spring and the first in autumn—ranges from 186 days in the extreme north to 250 days in the south. Killing frosts are unusual after April 10 over the greater portion of the northern half, and after March 15 in the Coastal Plain. In the north the average date for the first killing frost is October 27, and in the south November 15. [1]

GEOLOGY

The geology of Georgia is as diversified as its topography. The rocks of the State include the classes igneous (chiefly granites), metamorphic (schist, gneiss, marble, etc.), and sedimentary (and or sandstone, clay, shale, limestone). They range in age from recent to ancient (Archean) and in compactness from loose sand to hard quartzite and from soft marl to crystalline marble. They have been classified according to age and lithologic character into formations, the names of which appear in the table on pages 6 and 7 with the

[1]The most important sources of information about the climate of Georgia are Section Climatologies Nos. 85 and 86, obtainable at any Weather Bureau office.



MAP OF GEORGIA SHOWING THE LARGER GEOLOGIC AND TOPOGRAPHIC DIVISIONS.

By Wythe Cooke, Laurence LaForge, Arthur Keith, and M. R. Campbell

youngest at the top. The kind of topography which is characteristic of each formation and the general distribution of the formations are also indicated in the table.

The geologic map, Plate II, shows the distribution of the major divisions of the rocks of Georgia. The oldest rocks (Archean and metamorphic Cambrian) form a broad belt in the Highland and the Central Upland; the Paleozoic rocks, except the metamorphic Cambrian rocks, occupy the northwest corner of the State, in the Valley and the Lookout Plateau; and the Cretaceous, Tertiary, and Quaternary formations make up the entire Coastal Plain.

The attitude of the bedded rocks is different in each of these three areas. The oldest rocks are crystalline and are intricately contorted and metamorphosed; the Paleozoic rocks are closely folded and faulted at the southeastern side of the Valley, but flatten into gentle undulations toward the northwest; and the much younger sedimentary rocks of the Coastal Plain, which were deposited on the timeworn surface of the crystalline rocks, slope gently seaward or are almost level.

MINERAL RESOURCES

Georgia has a great variety of minerals and at present is producing more than a score in commercial quantities. Most of them are confined to the northern part of the State but extensive deposits of bauxite, white clay, and fullers earth are now being mined on a large scale in South Georgia. The commercial importance of the mineral products of the State are shown by the mineral statistics here given:

Value of Mineral Production of Georgia for 1923

Asbestos, Coal and Coke	$ 455,040
Barytes	670,343
Bauxite	141,975
Brick and tile	5,733,768
Clay	1,077,196
Fuller's earth and manganiferous ores	1,049,980
Gold and silver	530
Granite	1,462,297
Iron ore and ocher (latter estimated)	500,718
Lime and limestone	513,202
Marble	2,090,486
Sand and gravel	300,621
Mica, talc and soapstone	18,123
Mineral waters	58,810
Portland cement and slate	1,608,404
Total	$ 15,681,493

WATER SUPPLY AND POWER

The even distribution throughout the year of the abundant rainfall assures Georgia of ample water for all uses, including power. In the southern part of the State the water supply is obtained chiefly from artesian wells. These waters are generally hard but uncontaminated. In the northren part of the State springs, shallow wells and streams are the source of the domestic water supply.

GEOLOGIC FORMATIONS IN GEORGIA

Prepared By Wythe Cooke, M. R. Campbell, Arthur Keith and Laurence LaForge.

ERA	SYSTEM	SERIES	FORMATIONS		PREVAILING LITHOLOGY
CENOZOIC	QUATERNARY	Recent	Alluvial and swamp deposits; beach and dune sand		Sand, mud, muck, and peat.
		Pleistocene	Columbia group. Terrace deposits (0 to 50 ft.)		Chiefly sand.
	TERTIARY	Pliocene	Charlton formation (0-15 ft.)		Argillaceous limestone and clay.
		Miocene	Duplin marl (10-15 ft.)		Sandy shell marls and compact bluish sand.
			Alum Bluff group (0-150 ft.)		Chiefly sand, sandstone and claystone.
			Chattahoochee formation (0-100 ft.)		Earthy limestone.
		Oligocene	Vicksburg group: Glendon formation (0-100 ft.)		Chert-bearing sand, clay, and gravel on surface, white limestone under cover.
		Eocene	(In western Georgia)	(In eastern Georgia)	
			Ocala limestone (300 ft.)	Barnwell formation (0-200 ft.)	Soft white limestone; red sand and fuller's earth.
			Claiborne group (200 ft.)	McBean form.(80-100 ft.)	Claystone, sand, and sandy limestone.
			Wilcox formation(0-100 ft)		Chiefly laminated sand and clay.
			Midway form. (0-400 ft.)		Sand, clay, marl, and limestone.
MESOZOIC	CRETACEOUS	Upper Cretaceous	Ripley formation (900 ft.)		Dark gray sand, clay, and limestone in west; coarse white and pink sand and kaolin in east
			Eutaw formation(0-560ft)	Undifferentiated Upper Cretaceous (790 ft.)	
			Tuscaloosa form.(0-375 ft.)		Coarse micaceous sand and gravel.
		Jurassic or Triassic	Diabase and gabbro dikes		Mainly dark gray or black diabase, much jointed and weathered.
PALEOZOIC	CARBONIFEROUS	Permian (?)	Granites and pegmatites		Massive light-gray biotite-granite; lenses and narrow dikes of muscovite-biotite granite.
		Pennsylvanian	Walden sandstone (930-1000 ft.)		Sandstone and sandy shale; coal-bearing.
			Lookout sandstone (400-500 ft.)		Coarse sandstone or conglomerate and sandy shale.
		Mississippian	Pennington shale (515 ft.)		Gray and reddish shale with beds of sandstone and limestone.
			Bangor limestone (500-900 ft.)		Blue fossiliferous limestone, grading into shale at top.
			Hartselle sandstone (50-550 ft.)		Coarse white sandstone.
			Floyd shale (0-2000 ft.)		Black shale grading into limestone.
			Fort Payne chert (0-510 ft.)		Banded chert with a small amount of limestone.
		Devonian or Carboniferous	Chattanooga shale (0-100 ft.)		Fine black shale.

PALEOZOIC	DEVONIAN	Lower Devonian	Armuchee chert (50-100 ft.)	Bedded chert, rusty and sandy.
	SILURIAN		Red Mountain formation (600-1800 ft.)	Sandstone and sandy shale.
	ORDOVICIAN	Middle Ordovician	(Western basin.) Chickamauga limestone (1000-1500 ft.) / (Eastern basin.) Rockmart slate (1200-3000 ft.) Chickamauga limestone (100-200 ft.)	Rockmart slate is generally black, includes sandstone and conglomerate. Chickamauga limestone is generally blue; includes many beds of shale.
		Lower Ordovician		
	CAMBRIAN	Upper Cambrian	Knox dolomite (3000-5000 ft.)	Thick-bedded, gray, magnesian limestone or dolomite
			Conasauga formation (1000-4000 ft.)	Olive clay shale and thin-bedded limestone.
		Middle Cambrian	(In the Appalachian Valley) Rome form. (700-3500 ft.) Apison shale (1000 ft.) / Cartersville formation (600-1000 ft.) / (In the Highland and Central Upland.)	Rome formation contains variegated sandstone and shale. Cartersville formation contains sericitic schists and sandstone.
				Nottely quartzite (200 ft.) — Massive white quartzite.
			Shady limestone (800-1500 ft.)	Andrews schist (50-300 ft) — Calcareous schist, with iron ore.
				Murphy marble (50-300ft.) — Massive white, blue, or banded marble.
		Lower Cambrian		Valleytown formation (1200-2000 ft.) — Mica schist with many silicious beds and garnets.
			Weisner quartzite (2000-5000 ft.)	Brasstown schist (1200-1500 ft.) — Mica schist spangled with biotite crystals.
				Tusquitee quartzite (20-600 ft.) — White or grayish-white glassy quartzite.
				Nantahala slate (1000-2000 ft.) — Black or dark gray banded slate or phyllite.
				Great Smoky formation (5000-6500 ft.) — Massive gritty sandstone, graywacke, and fine conglomerate with many beds of dark slate or phyllite and gray mica schist.
			Hiwassee slate (1500-1800 ft) / Brevard schist (1000-ft.)	Dark banded slate with beds of quartzite, limestone and limestone conglomerate. / Dark phyllite and schist with beds of limestone and quartzite.
			Pinelog conglomerate	Fine quartz conglomerate, graywacke, and mica schist.
PROTEROZOIC	(?)		Various quartzites and schists	Massive white or light-colored quartzite, interbedded with mica schists.
	ARCHEAN		Biotite granites	Much squeezed and altered to gneiss and schist.
			Roan gneiss	Hornblende gneiss and schist, diorite, and gabbro.
			Carolina gneiss	Massive and banded mica gneiss, interbedded with mica schists containing garnet, cyanite and graphite.

The aggregate water power of Georgia is estimated at 2,381,800 10-hour horsepower. The greatest sources of power are in the northern part of the State but there is considerable power on many of the larger streams in south Georgia.

Summary of Georgia Water Powers

Watershed	Safe average daily output in 10-hour H. P.
Savannah	734,050
Ogeechee	9,300
Altamaha	251,550
Coastal Region	40,500
Apalachicola	935,300
Mobile in Georgia	297,000
Tennessee in Georgia	114,100
Total	2,381,800

Only a little more than ten per cent of these water powers as shown by wheel installation is at present developed. The main hydroelectric power companies operating in Georgia are here given together with the production in kilowatt hours for 1923:

Electricity Produced by Water Power in 1923

Georgia Railway & Power Company	KWH	232,807,570
Columbus Electric & Power Company	KWH	133,610,018
Central of Georgia Power Company	KWH	91,779,750
Augusta-Akin Railway & Electric Corp	KWH	54,383,893
West Point Electric Company	KWH	18,894,940
Athens Railway & Electric Company	KWH	17,409,962
Georgia-Alabama Power Co., Albany, Ga	KWH	13,097,837
Eagle & Phoenix Mills	KWH	11,424,000
Towaliga Falls Power Company	KWH	7,022,440
Bainbridge Power Company	KWH	1,439,080
All other hydropowers (estimate)	KWH	20,000,000
Total	KWH	601,869,490

AGRICULTURE

Soils. The soils of Georgia vary widely in physical and chemical character, depending upon the mineral composition of the rocks from which they have been derived. In the Great Valley of northwest Georgia the argillaceous soils formed from the sandstones and shales are quite different from the calcareous soils derived from the limestones, and the mixture of these two kinds gives rise to a third variety. In the Central Upland the soils, which are derived mainly from the granitic rocks or from hornblende rocks, are light or heavy according to the proportions of sand or clay in them. These soils are generally red, especially those derived from hornblende rocks. The soils of the Coastal Plain, being derived from limestones, clays, and sands, are calcareous, argillaceous, or sandy, the sandy soils predominating.

The color of soils ranges from very light gray through yellow and orange to red in well drained uplands and from gray or grayish blue to dark blue or mottled in poorly drained areas.

As nearly all the soils of Georgia are deficient in one or more of the plant foods, crops are noticeably increased by the use of fertilizers.

Most of the soils produce fair crops of corn, but some soils are much better than others for cotton, which does best on the uplands. The light sandy soils of the Coastal Plain are well adapted for growing tobacco, peanuts, sweet potatoes, and truck. The rate of growth of peach and pecan trees and the quantity and quality of their fruit vary greatly with the soil.

Chief crops. Georgia is preeminently an agricultural State. The value of the crops for 1924 has been estimated at $263,085,869. Cotton far exceeds in value that of any other crop and is approximately equal in value to all other crops combined. The following table shows the value of the leading crops:

Value of Leading Crops 1924

Cotton and cotton seed	$ 130,350,000
Corn	56,227,360
Hay	8,795,000
Sweet potatoes	8,704,000
Peaches	8,425,420
Tobacco	8,299,466
Peanuts	6,652,800
Oats	3,779,100
Sugar cane	3,607,031
Watermelons	2,795,625
Irish potatoes	2,412,000
Apples	1,762,760
Wheat	1,436,500

Georgia produces in addition to the crops here mentioned all other crops commonly grown in this latitude. The production per acre is variable but the general average is practically the same as that of the other southern Atlantic States. Corn leads in acreage but is closely followed by cotton.

Forests. The total area of forest lands in Georgia as given by the U. S. Forest Service is 20 million acres, of which all but one million acres has been cut over. There are some 6½ million acres of cutover land which contain second growth timber of some merchantable value for lumber, 7½ million acres which contain second growth unmerchantable except as cord wood; and 5 million acres of forest land classed as waste because it has been so severely cut and burned that it is producing nothing. The amount of forest land lying totally idle is equal to nearly 40 per cent of the cultivated farm land in the State. These figures show that less than one-twentieth of the original virgin forests remain and that wood-using industries are rapidly becoming dependent upon second growth timber or upon lumber imported from other states.

To offset the rapidly disappearing virgin forest, Georgia still contains within its boundaries vast areas of forest land which is not suitable and not needed for agriculture. This land is naturally adapted to the rapid growth of forests and offers an exceptional opportunity for reforestation on a commercial scale. That the people of the State are aroused to the betterment of forest conditions is shown by a bill now

pending before the legislature, the object of which is as follows: (1) To control and regulate forest fires and to develop public sentiment which recognizes the menace of forest fires and will cooperate in stamping them out. (2) To stop the destruction of young pine timber by improper and ruthless methods of turpentining. It is believed that the naval stores industry will readily cooperate in placing fair and reasonable restrictions upon operators. (3) To educate the people of the State to the value, importance, and necessity of forests and forest lands, and their products, to the end that there may be developed a sane and enlightened public attitude with respect to the forest situation and its urgency as a public problem.

Next to cotton, the forests of Georgia in the past have contributed in largest measure to the wealth of the State. The rich virgin forests of pine and hard wood have supported lumbering and turpentining, basic industries which have drawn to Georgia a billion and a half dollars in the last 25 years. However, on account of the decline of raw material produced by nature and not renewed by man as the original forests we e cut, the lumbering and naval stores industries are confronted in many parts of the State with practical extinction because of the destruction of local forests.

A census of manufacturers for 1919 showed that the wood products establishments in Georgia had a combined value of $66,340,207. The extent of these industries is apparent when it is stated that they comprise 50 per cent of the industrial establishments of the State, employ 22 per cent of Georgia wage earners, represent 10 per cent of the capital invested in manufactures and produce practically 10 per cent of the manufacturing wealth of the State.

OTHER INDUSTRIES

In addition to agriculture which gives employment to more than half of the population of the State there is a great variety of other industries. One of the most important of these is the textile industry. The total number of plants engaged in this industry is at present 190 which represents a capital investment in round numbers of 154 million dollars. The textile industry reached considerable development prior to the Civil War but has greatly expanded within the last few years because of the rapid development of hydroelectric power. Scarcely less important are the fertilizer industry, with 181 plants, representing a capital of $48,265,381, and the cottonseed oil industry, with 141 plants, representing an investment of $24,724,650. In addition to the industries above mentioned, the State Commissioner of Commerce and Labor lists 1,820 establishments engaged in various industries.

TRANSPORTATION

The total mileage of the public roads at present is estimated at 91,000, approximately 7 per cent of which is under the management of the State Highway Department. The State roads reach every county seat and are being rapidly improved. The total amount of money spent on the public highways last year, including federal aid, was $6,500,000. Many of the main highways leading to the cities and large towns are

paved and hundreds of miles of excellent sand-clay roads form a more or less complete network throughout the State.

Railroad construction began in the State at an early date. The Central of Georgia Railway from Savannah to Macon, 190 miles long, was put in operation in 1843 and two years later the Georgia Railroad was completed from Augusta to Atlanta, 171 miles. Many railroads were built prior to the Civil War but the greatest development has been since then. At present there are operated in the State 7,226 miles of railroad, exclusive of siding and yard track. Nearly all the counties of the State are served by one or more railroads.

Steamboat navigation is more or less active on the following rivers: Chattahoochee, Flint, St. Marys, Satilla, Altamaha including Ocmulgee and Oconee, Savannah and Coosa. The navigable parts of all these streams lie within the Coastal Plain except the Coosa which flows through the Great Valley. The boats plying these streams are small and usually operate during only part of the year. Prior to the introduction of railroads these rivers were important carriers of cotton, merchandise, food products, etc., but at present they are of only minor importance; nevertheless by proper improvement they could again be made to assume their former position as common carriers.

CIVIL DIVISIONS

Georgia is divided at present (1925) into 161 counties. All of the counties west of Oconee River and south of Altamaha River, except Glynn and Camden Counties, are divided into sections, districts, and land lots. The lots, the smallest subdivisions, range in size from 40 to 490 acres. The smaller lots are confined to Lumpkin and other counties in the northern part of the State in which gold is found.

East of Oconee River and north of Altamaha River, the "headright counties" are not subdivided. The average area of the counties is 364 square miles. The largest county is Burke (956 square miles) and the smallest Clarke County (114 square miles). In addition to the divisions above given each county is divided into militia districts to facilitate local government. The State is also divided into Congressional and Senatorial districts, the size of which is determined by the population.

POPULATION

The total population of Georgia according to the federal census of 1920, was 2,895,832. Of this number 1,689,114 were white, 1,206,365 were negro, and the remaining 353 were Indians, Chinese, Japanese, Hindus and Filipinos.

The urban population, or city dwellers, numbered 727,859 whites and 454,602 negroes, while the rural population included 1,234,512 whites and 933,329 negroes.

Although the negro population is widely distributed it is densest in the central, southwest and coast counties, where the negroes in places outnumber the whites. In two counties in this region there are more than twice as many negroes as white people.

In north Georgia the proportion of negroes ranges from one-eighth to one-quarter of the total population. Two mountain counties, Towns and Dawson, in this section, had in 1920 no negro population.

The foreign born white population in 1920 was 16,186. Russia, Germany, England, Greece and Ireland, in the order named, contributed the largest number of foreigners.

THE SURFACE FEATURES OF GEORGIA

INTRODUCTORY STATEMENT

By Laurence LaForge

THE STUDY OF SURFACE FEATURES

The land surface of the earth is not uniform, but is made up of features of different sorts, such as hills, valleys, mountains, plains and cliffs and many parts of it are occupied by bodies of standing or flowing water. It is this diversity of feature that gives character and charm to landscapes. All the features in any area, collectively, make up what is called its topography.

The scientific study of the surface features of the globe is a branch of physical geography. It is, however, a subject of such wide scope, of so many contacts with other sciences, and of such importance in human affairs that it has become virtually an independent science, which, in America, has commonly been called *physiography* or latterly *geomorphology.*

Geomorphology may be defined as the branch of Science that treats of the surface features of the globe, their form, nature, origin, and development, and the changes that they are undergoing. That part of the subject which relates more particularly to the origin, development, and changes of the features is often separately distinguished by the related term *geomorphogeny.*

Topographic features are of two primary sorts: the land features and the water bodies that occupy part of the surface. The form of the land surface, especially in regard to the differences in altitude and slope of its different parts, or, in other words, its roughness, is called the *relief,* and the surface forms are *features of the relief.* Much of the water that falls on the surface is drained away by running down the slopes to the lowest places to which it can flow, hence the surface water bodies, the streams, lakes, and swamps, taken collectively, have come to be known as the *drainage,* and the individual water bodies as *drainage features.*

Not only are surface features of different sorts, but they are grouped in many different ways, so that the surface of the globe presents a wide diversity of landscapes, each being a particular kind of grouping of certain topographic features, or, in other words, each having its own particular type of topography. The essential elements of relief in a topographic type are: (1) the general altitude and relief of the surface; (2) the kinds and grouping of the features, or the *relief pattern;* (3) the size of the features, or *scale* and (4) the nature of the surface. The essential elements of drainage are: (1) the size and abundance of the water bodies; (2) the extent and completeness of the drainage; (3) the kinds and grouping of features, or the *drainage pattern;* and (4) the grades of the streams. Relief and drainage are not independent of each other, as each is partly determined by the other, and both are

essential elements in the topographic type that results from their combination.

THE DEVELOPMENT OF SURFACE FEATURES

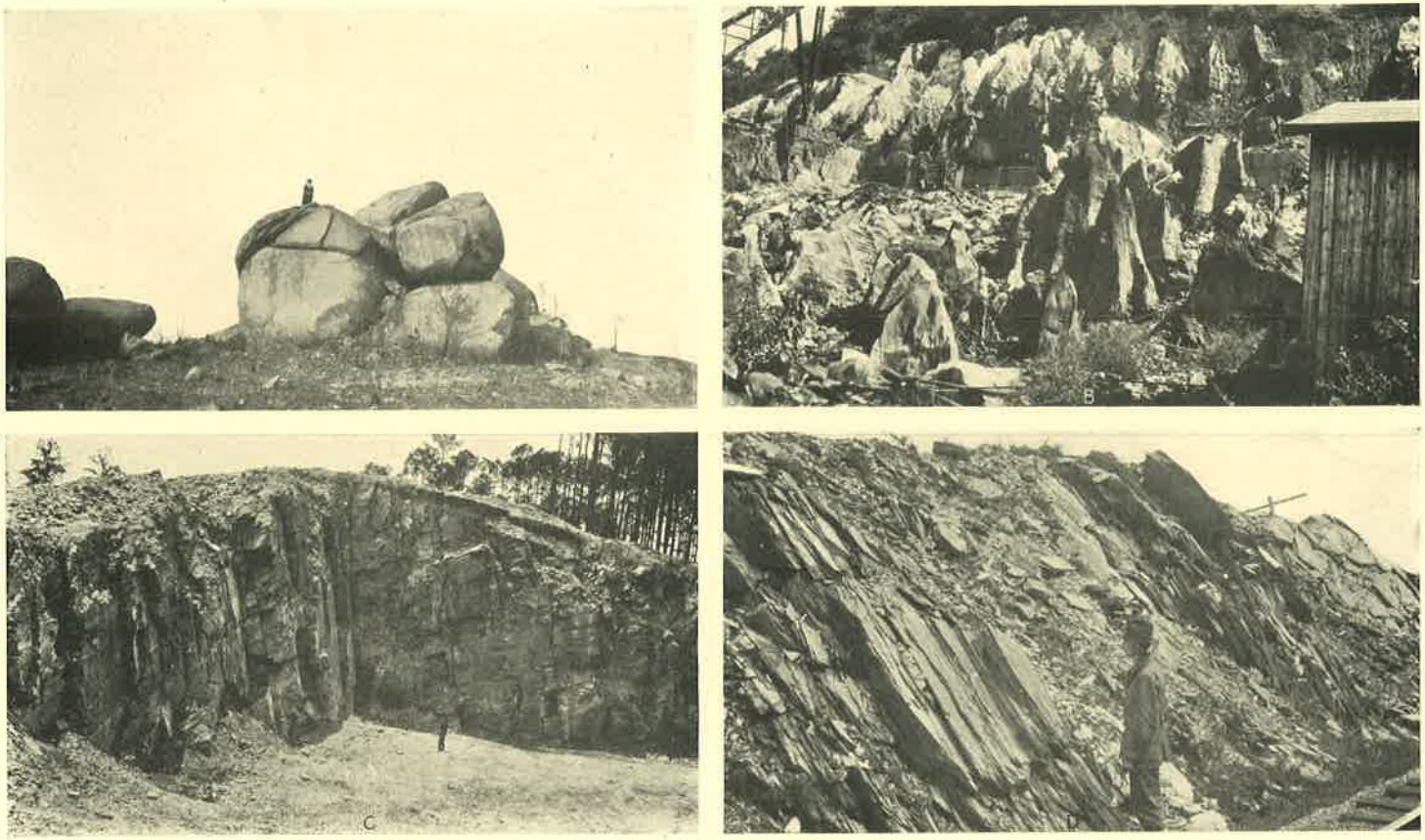
"There rolls the deep where grew the tree.
O earth, what changes hast thou seen!
There where the long street roars, hath been
The stillness of the central sea.

The hills are shadows, and they flow
From form to form, and nothing stands;
They melt like mist, the solid lands,
Like clouds they shape themselves and go."

(In Memoriam)

The diversified surface of the land, with its mountains, valleys, and plains, its streams, lakes, and swamps, its stretches of beach and dunes, its marshes, and its tidal inlets, has not always presented the same appearance as now. The landscape has undergone profound changes in the past, is being changed at present, and through further change will be wholly different in the future. The heat of the sun's rays and the action of rain and frost are breaking up the surface of the solid rocks and reducing them to fine material. The scour of the wind and the wash of falling rain remove the fine rock waste, which is carried away from summits and slopes and left in hollows, spread out on flats, or swept onward by the streams to a final destination in a large lake or the sea. There, mingled with other waste torn from the land by the beating of the waves, it is strewn by currents over the bottom or is thrown up by the surf to form new land along the shore. Nor are these all the changes. The seemingly solid crust of the earth is not everywhere at rest, but, slowly and almost imperceptibly, it is rising in some places and sinking in others, so that here the land is being extended by the emergence of the bottom, there contracted as it sinks beneath the waves, and elsewhere the courses of the streams are being shifted. On high mountains and in the polar regions glaciers grind away the rocks and remove the debris to be deposited perhaps thousands of miles away. Volcanoes build up great cones or pour out sheets of lava that cover the surface for miles around, and violent earthquakes cause greater changes than would have been wrought by ordinary processes in many centuries. Thus the earth's surface is by no means fixed and unalterable, but it is everywhere and always undergoing some sort of change.

Most of the change is so slow as to be scarcely noticeable in a single lifetime and even all the change since the beginning of human history is negligible in most parts of the world outside the regions of great earthquakes and volcanic eruptions. Geologic time has been so long, however, that even such slow changes have completely altered the face of the land again and again. The story of such changes is a part of geologic history as a whole and has its beginnings in the remote past of early geologic time. To explain the origin of the present surface



WEATHERING OF ROCK *Photographs by S. W. McCallie.*

DISINTEGRATION OF GRANITE (A) AND SOLUTION OF MARBLE (B). OPEN JOINTS (C) AND SLATY CLEAVAGE (D) PERMIT THE CIRCULATION OF GROUND WATER AND FACILITATE THE DEEP WEATHERING OF ROCKS.

features of Georgia, however, with which this discussion is concerned, it is not necessary to go back far into geologic history. These features, although extremely ancient from a human point of view, are, geologically speaking, rather recent.

The present form of the land surface in Georgia and elsewhere is the result of the work of natural agents. The various ways in which such agents operate to shape land surfaces are included under the general term *process*. The work of the agents is affected by the fact that different parts of the surface differ in position and in the character of the material forming them. The ways in which land surfaces differ in these respects, and which affect the results of the operation of the natural processes, are included under the general term *structure,* which students of surface form use in a much more inclusive sense than do geologists. Finally, as the change resulting from the operation of any process is necessarily progressive, the resulting form at any particular time depends on the *stage* to which the development has been carried. These three—*structure, process* and *stage*—are therefore of practically equal importance in determining the form of the land surface at any particular time, and any land form or group of forms constituting a type of topography can therefore be regarded as having been produced by the modification of a surface of a certain *structure* by some *process* carried to a certain *stage* of development of the form.

THE TOPOGRAPHIC DIVISIONS OF GEORGIA

As has already been pointed out, the topography of the State of Georgia is not uniform but differs widely in different parts of the State. Hence it is desirable to outline the several divisions recognized, before proceeding with the detailed description of the features of each.

The State lies in two of the major physiographic divisions of the United States: the Atlantic Plain on the southeast and the Appalachian region on the northwest. They are separated by an irregular line which crosses the State from Augusta through Milledgeville and Macon to Columbus and which coincides at several places with parts of the well-known Fall Line of the Atlantic slope. The Atlantic Plain occupies approximately 60 per cent and Appalachian Georgia 40 per cent of the area of the State.

The part of the Atlantic Plain within the State lies wholly in a single great province—the Coastal Plain—which borders the coast of the United States from southern New England into Mexico. Appalachian Georgia, on the other hand, includes parts of four provinces, all of which extend far beyond the boundaries of the State. These provinces are the Piedmont Upland, the Appalachian Mountains, the Appalachian Valley and Ranges, and the Appalachian Plateaus. Their position and boundaries in the southeastern States are shown in fig. 1. The Piedmont Upland extends from Hudson River to central Alabama and crosses Georgia in a broad belt north of the Coastal Plain. It includes more than three-fourths of Appalachian Georgia. The Appalachian Mountains, which extend across southwestern Virginia and western North Carolina and South Carolina into Georgia, occupy the

northeastern part of the State. The Appalachian Valley and Ranges also extend from New York State to central Alabama, crossing the northwestern part of Georgia. The extreme northwest corner of the State lies in the Appalachian Plateaus, another province that extends from New York State into Alabama, but barely enters Georgia. Each province as a whole comprises several sections, but, except in the Piedmont Upland, only a part of one section of each province is in Georgia. In all the provinces each section comprises minor subdivisions that differ in importance and in distinctiveness.

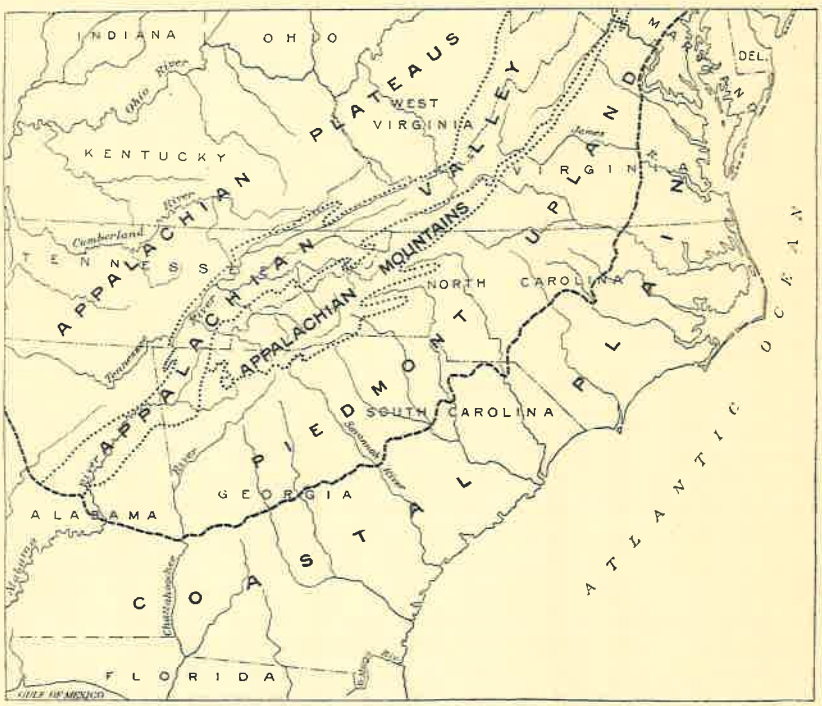


Figure 1. The Geographic Provinces of the Southeastern United States

The provinces of the Appalachian region were established and named on the basis of characters and relations displayed elsewhere in the region. The general character and relations of two of them are not well shown in Georgia and the names of all four mean little when only the parts of them within the State are considered. It seems best, therefore, in the following descriptions, to give the Georgia parts of the provinces distinctive names of local significance. Thus, the part of the Piedmont Upland within the State has been named the Central Upland, the Georgia part of the Appalachian Mountains has been named the Highland, the Georgia part of the Appalachian Valley and Ranges has been named the Valley, and the part of the Appalachian Plateaus

within the State has been named the Lookout Plateau. The positions and outlines of the provinces are shown on Plate II. The sections and minor divisions of the provinces are named and defined in the detailed descriptions of the provinces and their positions and outlines are shown in the index maps, figs, 2, 3, and 4, and Plate XXIX-B.

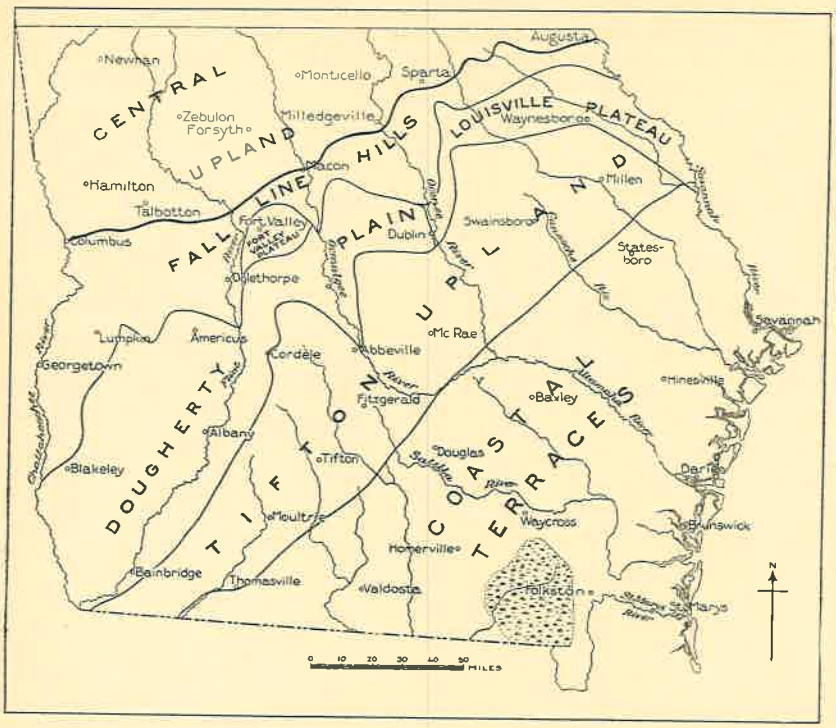


Figure 2. The Topographic Divisions of the Coastal Plain of Georgia.

THE COASTAL PLAIN

By Wythe Cooke

GENERAL RELATIONS

Location, size, and distinctive characteristics. All that part of Georgia south of a crooked line connecting Columbus, Macon, Milledgeville, and Augusta lies within the Coastal Plain. This includes an area of nearly 35,650 square miles, three-fifths the total area of the State.

The Coastal Plain differs from the Central Upland, which adjoins it on the north, chiefly in the kind of rocks that underlie it. The Central Upland is underlain by ancient granites and other crystalline rocks and by the products of the decomposition—chiefly sand and clay—of such rocks. The Coastal Plain is built of much younger water-lain deposits of sand, clay, and limestone resting upon a foundation which is the buried continuation of the crystalline rocks of the Central Upland. On many of the ridges it is difficult to determine where the Central Upland ends and the Coastal Plain begins, for the residual sand on the surface of the Central Upland is very similar to the sand of the Coastal Plain; but in the valleys and along the stream beds the line between the two can be drawn more sharply, for the hard, unweathered crystalline rocks crop out in the bed or banks of the streams and give rise to falls or rapids, whereas the softer and in many places quite unconsolidated sediments of the Coastal Plain offer little obstruction to the streams. Falls are so numerous and so characteristic along the boundary between the Central Upland and the Coastal Plain that the line joining the points where the streams cross the boundary is called the Fall Line.

Geology. The geology of the Coastal Plain is less complex than that of other parts of the State. The region is underlain by sediments ranging in age from Upper Cretaceous to Recent which crop out in roughly parallel bands with the oldest resting upon the crystalline rocks of the Central Upland and the youngest at the sea coast. The beds dip gently southeastward at rates ranging from about 35 feet to the mile at the Fall Line to very little at the coast.

The Upper Cretaceous deposits consist of coarse, light-colored, cross-bedded arkosic sands and clays obviously derived from the granitic rocks of the adjoining Central Upland, and finer, more regularly bedded, dark-gray or bluish sands with a few ledges of sandy limestones containing marine fossils. The kaolin and bauxite deposits are of this age. The outcrop of the Upper Cretaceous beds is confined to the Fall Line Hills (compare Pl. II and Fig. 2).

Beds of Eocene age make up the southern part of the Fall Line Hills, the Louisville Plateau, the Fort Valley Plateau, and part of the

Dougherty Plain. Red sand is the predominant constituent of the Eocene, except in the Flint and lower Chattahoochee valleys, where white limestone forms the top of the series.

Oligocene sand, gravel, and loam containing lumps of fossiliferous flint cover most of the Dougherty Plain and smaller areas at the eastern end of the Tifton Upland and the Louisville Plateau.

Miocene sand and gravel are almost coextensive with the Tifton Upland, but are visible also where the surficial cover has been removed from the coastal terraces.

Thin beds of Pliocene marls are exposed along Satilla and St. Marys rivers, but their areal extent is negligible.

Pleistocene sands cover most of the coastal terraces (see Plate II), but the deposits, except near the shore, are thin and at many places form merely a veneer on older beds.

Subdivisions. The word "plain," used in the combination "Coastal Plain," is less suitable in Georgia than in some of the states farther north, for much of the Coastal Plain of Georgia is not level. It is true that great stretches in the southeastern part of the State are flatter than the sea bottom itself, but other parts are rolling or hilly. The surface features of the Coastal Plain are so diversified that its different parts must be described separately. Its most conspicuous divisions described in the following pages are these: the Coastal Terraces, the Tifton Upland, the Dougherty Plain, the Louisville Plateau, the Fort Valley Plateau, and the Fall Line Hills. A map of these divisions is shown in Figure 2.

SCENES ON ST. SIMONS ISLAND. *Photographs by Wythe Cooke.*

A. FREDERICA RIVER AND THE MARSHES.
B. EROSION ON THE BEACH NEAR ST. SIMON LIGHT
C. WIND EROSION.
D. A SAND DUNE.

TOPOGRAPHIC DIVISIONS OF THE COASTAL PLAIN

COASTAL TERRACES

The coastal terraces in Georgia cover an area of about 18,000 square miles, or about half of the Coastal Plain. They extend inland from the Atlantic Ocean about 60 miles on the eastern boundary of the State and about 175 miles along the Florida line. The inner margin passes from the Florida line at Ochlockonee River to the vicinity of Thomasville and thence northeastward through Allapaha to Savannah River east of Sylvania. In addition to this main area, a large embayment extends into the Dougherty Plain between Donaldsonville and Bainbridge and up the valley of the Flint probably at least as far as Baconton. This embayment is not shown in Fig. 2 but part of it is indicated in Plate X-A.

The soils of the coastal terraces are chiefly gray sands and sandy loams except in the swamps where the prevailing sands are covered by muck or peat. Cotton, corn, and peanuts are the principal crops, but a great variety of agricultural products can be grown. Rice is an important staple in the marshlands near the mouths of the larger rivers, especially the Altamaha. Truck farming is becoming of increasing importance. Lumber and naval stores were formerly produced in great quantities but the virgin forests of long-leaf pine that once covered most of South Georgia have fallen before the axe of the lumberman.

Savannah, the principal city of the Coastal Plain and the most important port, is the greatest market for Sea Island cotton in the world. Brunswick is an important seaport. St. Marys and Darien are seaports at the mouths of St. Marys River and Altamaha River. Waycross and Valdosta are thriving railroad centers. Many cante oupes are shipped from Valdosta.

Veatch[1] recognized two coastal terraces to which he applied the names Satilla Coastal Lowland and Okefenokee Plain. The recent publication by the U. S. Geological Survey of detailed topographic maps covering part of the Coastal Plain of Georgia east of the eighty-second meridian, together with field work by the writer has made possible the recognition of three additional terraces in this region. It is probable that if more of the area were mapped at least one other terrace could be detected. The five terraces named in the order in which they are crossed in going inland from the sea and the approximate altitudes at which they stand are as follows:

Satilla terrace	0- 60 feet above sea level.
Penholoway terrace	60-100 feet above sea level.
Okefenokee terrace	100-160 feet above sea level.
Claxton terrace	160-215 feet above sea level.
Hazlehurst terrace	215-260 feet above sea level.

A map of the coastal terraces is shown in Plate X.

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1. Veatch, Otto, Georgia Geol. Survey Bull. 26, p. 28, 1911.

SATILLA TERRACE

The Satilla terrace is the lowest of the coastal terraces. It extends from the Atlantic Ocean inland an average distance of about 30 miles, and falls into three natural subdivisions, the mainland, the marshes, and the Sea Islands.

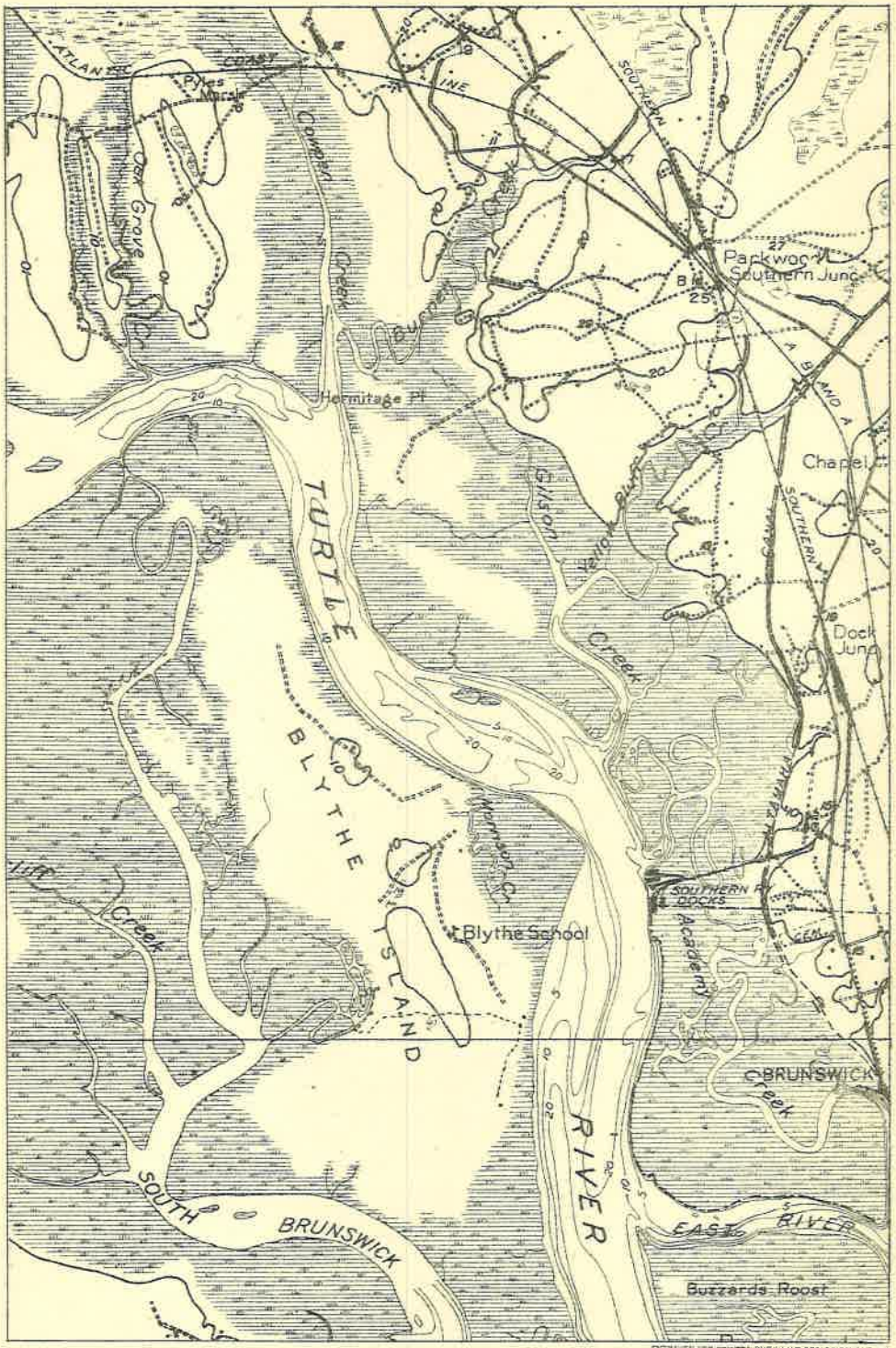
The mainland. The mainland stands at an average height of 20 feet above sea level. A few small areas rise above 30 feet and a few lie below 10 feet, but by far the greater part is between 15 and 25 feet. Rainwater collects in an intricate system of shallow sags and drains off very slowly. These moist places form densely wooded swamps or "bays."

The mainland is broken into peninsulas by salt marshes and tidal rivers which deeply indent its outer margin (see Plate V). Between the St. Marys and the Altamaha rivers there are five such peninsulas; there are 9 or 10 between the Altamaha and the Savannah Roads encircle the peninsulas, but do not cross the separating marshes.

The inner or landward margin of the Satilla terrace presents features which are especially interesting because they throw light on the early history of the region. Between Savannah River and Altamaha River the inner margin is a smooth curve, concave toward the sea (see Plate X-A), broken only by long reentrants running up the valleys of Savannah, Ogeechee, Canoochee, and Altamaha Rivers. In curvature and smoothness this line bears a striking resemblance to the cuspate shore of the Carolinas between Cape Fear and Georgetown, S. C. South of Altamaha River the boundary forms part of another cusp but several lagoon-like projections from the Satilla terrace indent the adjacent Penholoway terrace. This part of the boundary resembles the present shore line of the east coast of Florida. The course of Satilla River, which runs southward for 27 miles behind a barrier of Penholoway terrace in most places less than three miles wide, is analogous to that of Waccamaw River in South Carolina which flows for miles parallel to the coast and very near it. The reentrant of Satilla terrace between Satilla and St. Marys rivers where they are closest reminds one of Winyah Bay, where the Waccamaw breaks through to the Atlantic.

The marshes. The marshes, made famous by Sydney Lanier as the Marshes of Glynn, lie between the Sea Islands and the mainland and extend between the peninsulas of the mainland. They run along the entire coast line of the State, but are cut through by several rivers and sounds. The highway from Brunswick to St. Simon Island crosses them. Photographs of the marshes are shown in Plates IV-A, VI-A, and VI-B. Plate V represents an area of marsh near Brunswick.

The marshes stand near sea level. A large part of them is submerged daily at flood tide, but the higher areas are covered only during storms or exceptionally high water. They support a rank growth of marsh grass and sedges, whose tender green of early spring or pale yellows of autumn, varying in shade with the passing of every cloud, lends a charm which is lacking in the nearly equally level expanses of the adjoining wooded mainland. The rustle of the grasses in the breeze



DRAWN AND PRINTED BY THE U.S. GEOLOGICAL SURVEY

Part of the Bladen sheet

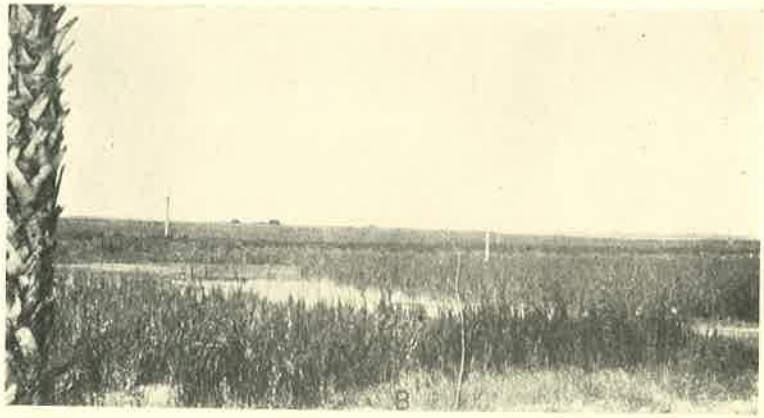
MAINLAND AND MARSHES NEAR BRUNSWICK

Scale 62,500

0 ½ 1 2 3 Miles

Contour interval 10 feet

Datum is mean sea level



Photographs by Wythe Cooke.

A. WILMINGTON ISLAND AND WILMINGTON RIVER.
B. MARSHES AT THE MOUTH OF SAVANNAH RIVER.
C. SATILLA RIVER NEAR WAYCROSS.
D. OCHLOCKONEE RIVER.

and in the ebb and flow of tide, the cheep of myriads of frogs the twitter of rice birds, the scampering of hordes of fiddler crabs, and the many mysterious murmurs of the marsh make the marshes of Glynn a paradise for poet or naturalist.

The Sea Islands. The Sea Islands lie off the Atlantic coast between the mouth of Santee River in South Carolina and St. Johns River in Florida. They are most typically developed in the vicinity of Beaufort, S. C. The most important of the islands in Georgia, named from south to north, are Cumberland, Jekyl, St. Simon, Sapelo, St. Catherine, Ossabaw, and Tybee

Cumberland Island and Little Cumberland Island together stretch 18½ miles in the direction N. 10° E. The maximum width is 3 miles. In shape they roughly resemble a snowshoe with the toe pointing northward. The seaward side is a sinuous line of sandy beach, concave toward the ocean at the southern half, convex in the north, and cut through 2 miles from the north end by Christmas Creek, which separates Little Cumberland Island from the larger mass. The south end is a crescent-shaped sand spit with its free end pointed northwestward, partly enclosing the salt marshes fronting on Beach Creek, and dotted with sand dunes 20 feet high. The north end of Little Cumberland Island has the form of a spit three-quarters of a mile long, pointed westward at right angles to the trend of the beach, but filled in behind so that it no longer is free. The beach of Little Cumberland Island and the middle part of the beach of Cumberland Island are backed by sand dunes, some of which rise 40 feet above sea level. The wooded interior of Cumberland Island stands at an average altitude of 20 feet above sea level, but a few points in the center, which appear to be ancient dunes, rise to 50 feet. The western shore of Cumberland Island, except the few places where it is swept by tidal rivers, is fringed by salt marsh. Access to the island is had from the inland waterways on the west.

Jekyl Island, 7¼ miles long, presents a gently convex curve to the ocean. At both extremities the beach is bent westward into spits backed by salt marsh. The average width of the island is about one mile. Sand dunes are conspicuous at the northern end and can be seen from St. Simons. A distant view of Jekyl Island appears at the left of Plate IV-B.

St. Simon Island is the largest of a compact group of islands between St. Simon Sound and Altamaha River. The backbone of St. Simon Island is a sand ridge about 11 miles long extending southward from Hampton River which separates it from Little St. Simon, and terminating in a broad, westward-curved hook at St. Simon Sound. On both sides of this ridge are salt marshes. The marsh on the west extends to Frederica River, a view of which is shown in Plate IV-A. East of the main ridge is Bloody Marsh, which is cut through by Postells Creek, Black Bank River, and Hampton River. A sandy coastal ridge branches off from the central ridge at the south end of the island and extends N. 30° E. 2½ miles from St. Simon Light and terminates at the inlet of Postelle Crsek and Black Bank River. The continuation o

this ridge beyond the inlet a distance of 4½ miles to Hampton River makes Long Island (Isle of Palms of Coast Charts), which is separated from St. Simon Island by Black Bank River and Village Creek. Sand dunes, few of which exceed 30 feet in height, fringe the inner edge of the coastal ridge. (See Plate IV-D.) The south end of St. Simon Island east of the light house at the entrance to St. Simon Sound is being rapidly eroded by the waves. The beach has been swept away and the underlying ancient salt marsh deposits attacked. Old live oaks near the edge of the island have been undermined and uprooted. (See Plate IV-B, C.) The opposite process is going on not far to the westward on St. Simon Sound, where considerable accretion has taken place during the past 60 years. Old houses once near the shore are now separated from the sound by a shallow lagoon and a broad sandy beach. A causeway built in 1923-24 connects St. Simon Island with the mainland.

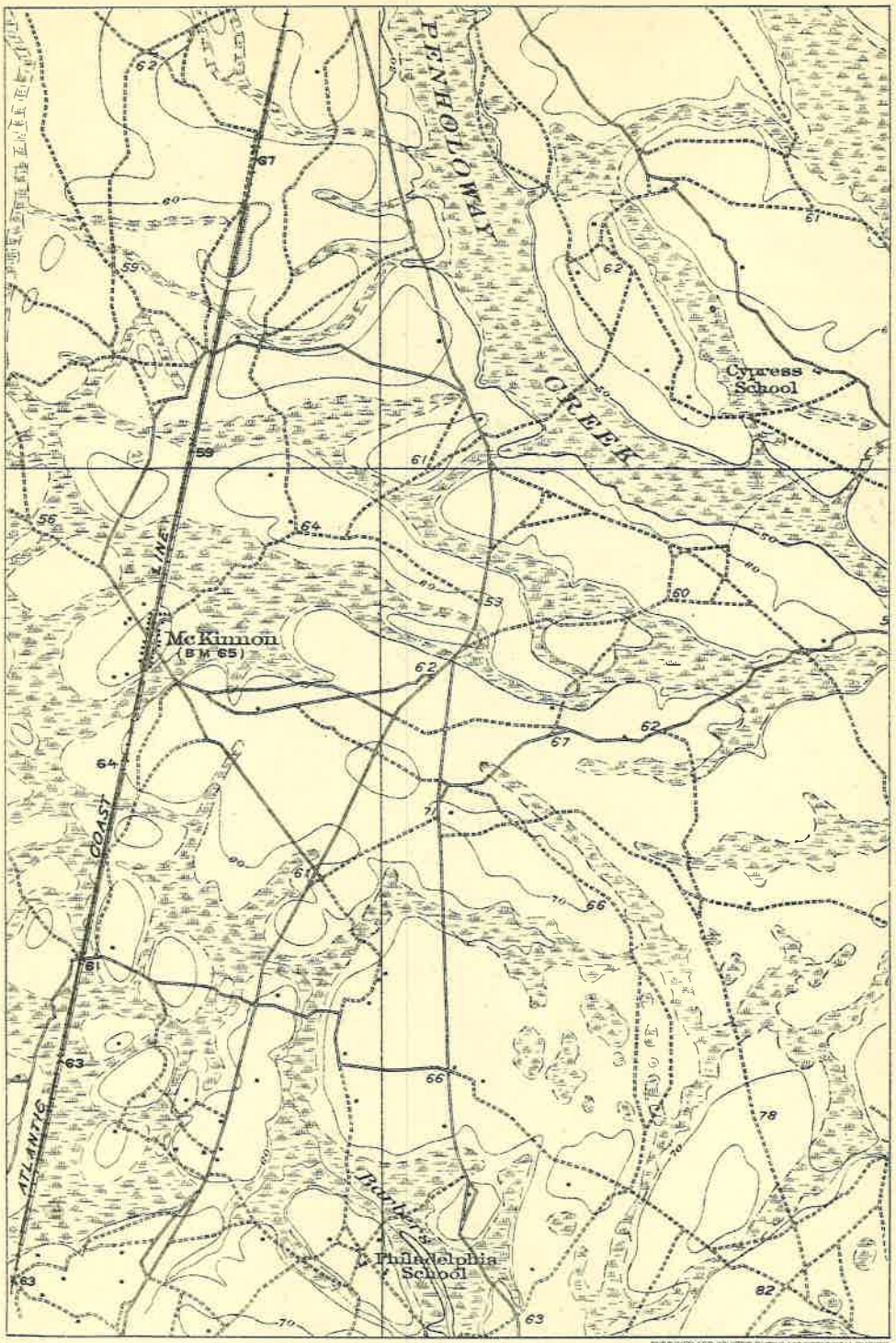
Sapelo Island and Blackbeard Island, the first important group north of Altamaha River, together form a roughly rectangular mass 9 miles long by 2 to 2½ miles wide. St. Catherine Island, 8½ miles long and 2½ miles across at the widest part, is nearly half marsh land. Ossabaw Island, about the same length as the others but somewhat wider, consists of several parallel strips of sand separated by narrow marshy lagoons.

Between Ogeechee River and the Savannah the island system is more complex. The islands are distributed in three or more tiers parallel to the coast line, more after the pattern of the Sea Islands in South Carolina. The most important of this group are Wassaw, Skidaway, Isle of Hope, Whitemarsh, and Tybee. The three last named are crossed by the highway from Savannah to Tybee. Tybee Island is a V-shaped sandbar fronting 3¾ miles on the Atlantic and 2½ miles on Savannah River. Some of the marshes between the prongs of the V have been reclaimed for building lots. There are a few sand dunes on the island, but they are not so large or so active as the dunes on St. Simons Island. The shore of Wilmington Island, cliffed by the waves of Wilmington River, is shown in Plate VI-A.

PENHOLOWAY TERRACE

The area selected as the type of the Penholoway terrace extends from Hortense, Brantley County, northeastward to Penholoway Bay and Penholoway Creek (see Plate VII).

The shape of the Penholoway terrace is more irregular than that of the Satilla terrace, which it adjoins. Starting from a cape-like termination at Baileys Mill in the big bend of Satilla River, (see Plate VIII), the boundary between the Penholoway terrace and the Satilla terrace runs northward for 8 miles, then curves slightly eastward to the corner of Camden, Glynn, and Wayne counties, where it is indented by an embayment of the Satilla terrace at the head of Little Satilla River. It then proceeds N. 20° E. near the Glynn-Wayne county line at Altamaha River, but is interrupted by embayments of Satilla terrace at the heads of Turtle River and Little Buffalo Swamp.



Part of the Hortense sheet

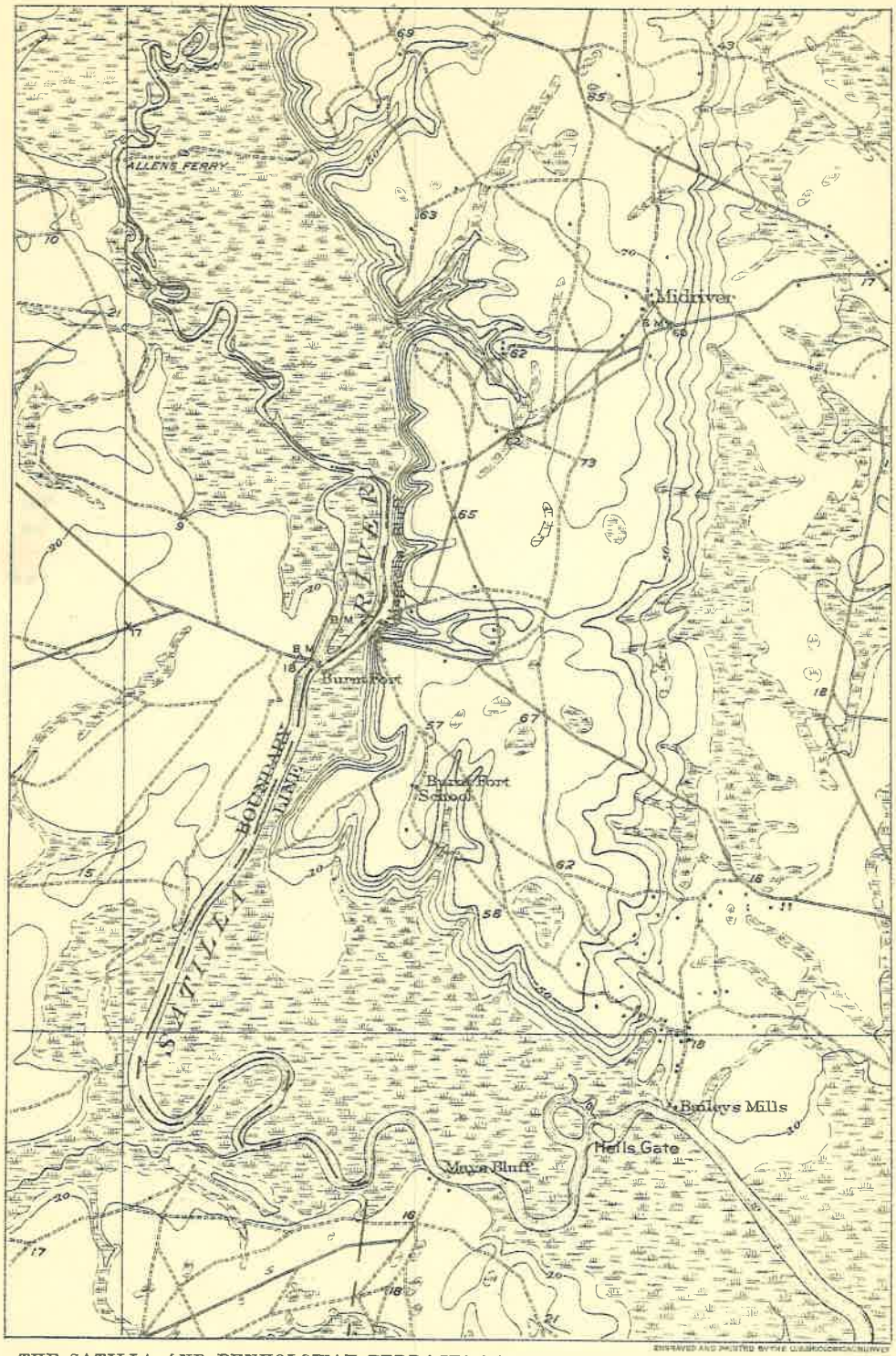
THE PENHOLOWAY TERRACE NEAR McKINNON

Scale $\frac{1}{62500}$

1 ½ 0 1 2 Miles

Contour interval 10 feet

Datum is mean sea level



THE SATILLA AND PENHOLOWAY TERRACES IN CHARLTON AND CAMDEN COUNTIES

Scale $\frac{1}{62500}$

1 0 1 2 Miles

Part of the Boulogne sheet

Contour interval 10 feet

Datum is mean sea level

The boundary thus outlined is a well-defined escarpment which rises, in most places within half a mile, from 16 to 18 feet above sea level on the Satilla terrace to 60 or 70 feet on the Penholoway. The highest point indicated on the topographic maps along this escarpment is 78 feet above sea level at Bixley Chapel, 8 miles west of White Oak. Several flat benches of Satilla terrace standing about 45 feet above sea level and averaging less than one square mile in area are found at intervals along the escarpment. One of the largest is 6 miles due west of Waverly, Camden Co.

North of Altamaha River, the only part of the Satilla-Penholoway boundary shown on topographic maps is a strip in Liberty County 15 miles long running from Canoochee River near Trinity through Hinesville and Allenhurst. The scarp is similar to that south of Altamaha River, but the highest point recorded is 92 feet above sea level at Walthourville. Between Flemington and Canoochee River the intermediate bench at 45 feet attains a maximum width of one mile.

The largest embayment of the Satilla terrace into the Penholoway terrace enters between capes 7½ miles apart. The northern cape is back of Baileys Mills on Satilla River (see Plate VIII); the Southern is at Prospect Landing on the Florida side of St. Marys River. Just inside the capes, the bay branches; the southern fork, 1½ to 2½ miles wide, follows up the valley of St. Marys River about 5 miles to the mouth of Spanish Creek, beyond which it merges with the normal valley of the river. The other fork leads almost due north for 27 miles to the forks of Satilla River with a width varying from 4 miles at Burnt Fort to 1½ miles between Lulaton and Atkinson. Its altitude in few places exceeds 30 feet above sea level. At the forks of Satilla River, with a width of 2½ miles and an altitude of less than 40 feet above sea level, the embayment of Satilla terrace turns west, splits again, and follows the valleys of Satilla River and Little Satilla River. Above the river forks, the plain rises gradually up-stream and appears to be a normal river terrace.

The Satilla River embayment is separated from the main Satilla terrace by a long, narrow peninsula of Penholoway terrace (see Plate VIII). At Waynesville and Atkinson the peninsula is six miles wide; it has narrowed to four at the corner of Glynn, Camden, and Wayne counties; below the corner, its average width is about 3 miles.

The western or inner boundary of the Penholoway terrace crosses St. Marys River near Stokesville, runs northward along the foot of Trail Ridge, passing two miles west of St. George, two miles west of Uptonville, and about 5 miles west of Nahunta. Between the forks of Satilla River and Little Satilla River there appears to be an embayment which carries the Penholoway terrace to the western edges of Cross Swamp and Zero Bay, 5 miles east of Blackshear and one mile east of Offerman, but because of lack of topographic maps its outlines have not been accurately determined. The main inner boundary continues from the edge of Duck Pond Swamp, 3 miles west of McKinnon, northeastward to Altamaha River at Doctortown, but is broken by an embayment which extends up Walker Creek. North of Altamaha River

the boundary is crooked and more difficult to define. A reentrant extends an undetermined distance up Altamaha River. From Donald, the line zig-zags in a general northerly direction to Canoochee River near Moodys Bridge, up the branches of Black Creek, crosses Ogeechee River to Guyton, and passes west of Springfield and Clyo to Savannah River near Hognose Point.

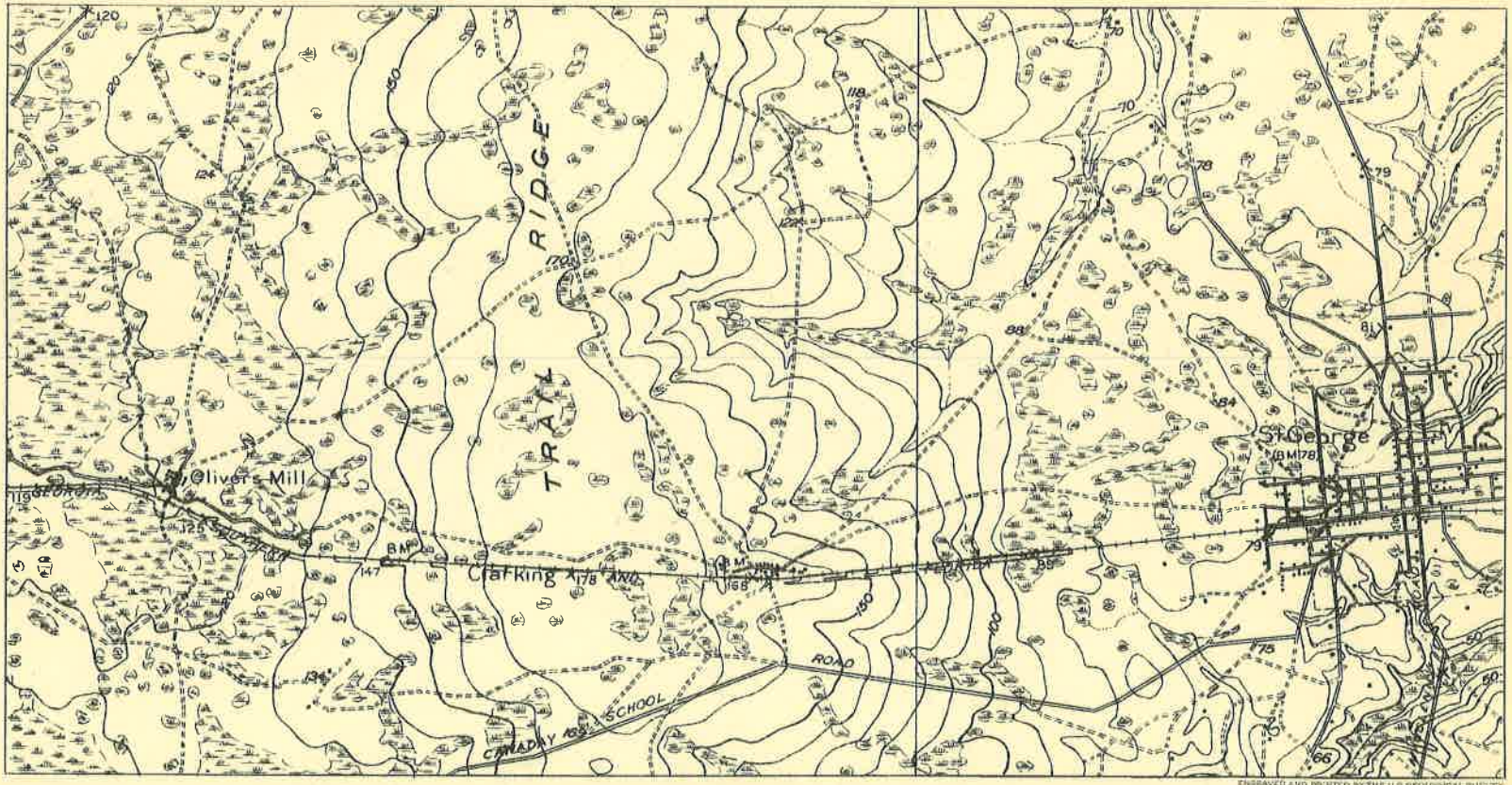
The Penholoway terrace is so flat that it is poorly drained and a large part of it is swampy. In many places the surface is marked by a series of low, wave-like undulations (old bars) which run generally parallel to the margins of the terrace and direct the drainage into north or south lines. The country is broken into narrow low sand ridges separated by narrow strips of swamp. The ridges may be as much as twenty feet higher than the adjacent swamps, but the slopes are so gentle that the difference in altitude is inconspicuous. The area drained by Penholoway Bay and Penholoway Creek forms somewhat of an exception to this rule, for its drainage pattern is an intricate system of curves like that of tidal marshes (see Plate VII).

The altitude of the southern part of the Penholoway terrace varies from a foot or two less than 70 to about 95 feet above sea level. The highest parts are not at the foot of Trail Ridge, which forms the western escarpment, but on the low ridge overlooking Satilla River. The long narrow peninsula east of Satilla River is a little lower than the mainland. Altitudes in the Penholoway Bay region range from 55 to 75 feet above sea level, and on the ridge east of it, between Winslow and Browntown, reach 85 feet. The little peninsula running southwest from Mt. Pleasant lies between 50 and 60 feet above sea level. West of Hinesville is a broad expanse of Penholoway terrace standing between 70 and 80 feet above sea level and imperfectly drained by a ramifying system of swamps. Boggy Pond and the adjacent bays, near Pembroke, are at the same altitude. South of Springfield are several parallel ridges (one reaching 95 feet) separated by swamps little more than 50 feet above sea level.

OKEFENOKEE TERRACE

The Okefenokee terrace occupies a greater area in Georgia than either the Penholoway or the Satilla. (See Plate X-A). It is as much as 50 miles wide at some places. Its eastern border in the southern part of the State is formed by the nearly straight Trail Ridge, (see Plate IX) which passes a few miles west of St. George, Uptonville, and Hoboken, and is cut off by an embayment of Penholoway terrace up Satilla River and Little Satilla River. From Waycross to Doctortown the division between the Okefenokee and the Penholoway lies not far east of the Atlantic Coast Line Railway. North of Altamaha River, it is a very crooked line passing through Pembroke and Guyton.

The western boundary of the Okefenokee terrace can be accurately defined only north of Altamaha River, where it can be traced on topographic maps. In this area it is almost straight, except for embayments running up Ogeechee and Canoochee rivers, and passes one mile west of Newington, through Brooklet, and 4 miles east of Glennville. South of the Altamaha, its position is known only approximately. It ap-



Part of the Moniac sheet

OKEFENOKEE TERRACE, TRAIL RIDGE, AND PENHOLOWAY TERRACE NEAR ST GEORGE

Scale $\frac{1}{62500}$

1 ½ 0 1 2 Miles

Contour interval 10 feet

Datum is mean sea level

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pears to cross the Southern Railway between Odum and Brentwood, to pass southwestward to Millwood, thence southward, between Homerville and Argyle, and to make a broad curve westward past Lake Park and up the Withlacoochee Valley to Ousley; thence southwestward to Monticello, Fla. A small embayment of Okefenokee terrace extends up Ochlockonee River into Grady County, and a much larger embayment, entering at the southwestern corner of the State, passes between Donaldsonville and the foot of the Tifton Upland east of Bainbridge and extends up the valley of the Flint almost to Baconton. (See Plate X-A.)

The Okefenokee is the flattest of the coastal terraces. In spite of its altitude of over a hundred feet above sea level it has suffered little dissection, and areas of many square miles show a total relief of less than ten feet. Because of its flatness, much of it is incompletely drained and swampy. Okefenokee Swamp, the second largest swamp in the United States, forms part of it and gives its name to the terrace.

In the bend of St. Marys River at the extreme southern end of the State, a few high points on the Okefenokee terrace reach 130 feet above sea level, but by far the greater part stands within three feet above or below 120. Those parts of Okefenokee Swamp that have been mapped are also very near the same altitude and show little differences in level. Profiles along the Atlantic Coast Line Railway show a rise from 137 feet above sea level at Waycross to 163 at Dandy's Still, 2½ miles east of Homerville, or 26 feet in 23 miles, the direction being S. 65° W. From Mile 60, near Waycross, to Mile 78, near Millwood, the rise is from 144 to 165, 21 feet in 18 miles, direction N. 80° W. West and northwest of Jesup are remnants of a sandy plain ranging from 130 to 160 feet above sea level which has been considerably dissected because of its nearness to Altamaha River. This plain is bordered on the east by a low sandy ridge which slopes from 150 feet down to 120 feet. At the foot of this ridge and extending from Slover to Oglethorpe Bluff and Jesup is a wedge of lower land ranging from 90 to 120 feet above sea level, which borders the Penholoway terrace, here about 60 feet above sea level. A peninsula six miles long and a mile and a half wide projects southward into the Penholoway terrace.

Between Altamaha River and Canoochee River the Okefenokee terrace is a narrow strip ranging in altitude from 120 feet to 110 feet above sea level and 60 feet below the Claxton terrace on the west and about 20 feet above the Penholoway terrace. North of the Canoochee, the terrace is much wider but very irregularly indented on the outer margin. Along the Savannah & Statesboro Railway the plain slopes southeastward from an altitude of nearly 160 feet at Brooklet to 100 feet above sea level near Hubert. The rate of slope at the western boundary is nearly 20 feet per mile, but it flattens out within a mile and a half to less than 3 feet per mile. In the region between Ogeechee and Savannah rivers, the Okefenokee terrace slopes from 150 feet above sea level at Newington to 129 at Kildare, 124 at Shawnee, and 100 at Guyton.

Trail Ridge. Trail Ridge (see Plate IX) is sufficiently interesting to merit separate description. Starting north of the lakes at the head

of Santa Fe River in Florida, a few miles south of latitude 30° N., Trail Ridge runs north to latitude 31°, near the northern boundary of Charlton County. North of this line it has not been traced, but the soil, as mapped by the U. S. Bureau of Soils, indicates that it continues with a slight easterly trend to the swamps bordering Satilla River. Its continuation beyond Little Satilla River is shown on topographic maps of the Hortense and Jesup quadrangles as far as 31° 38′, 4 miles northwest of Jesup. The ridge is about 130 miles long.

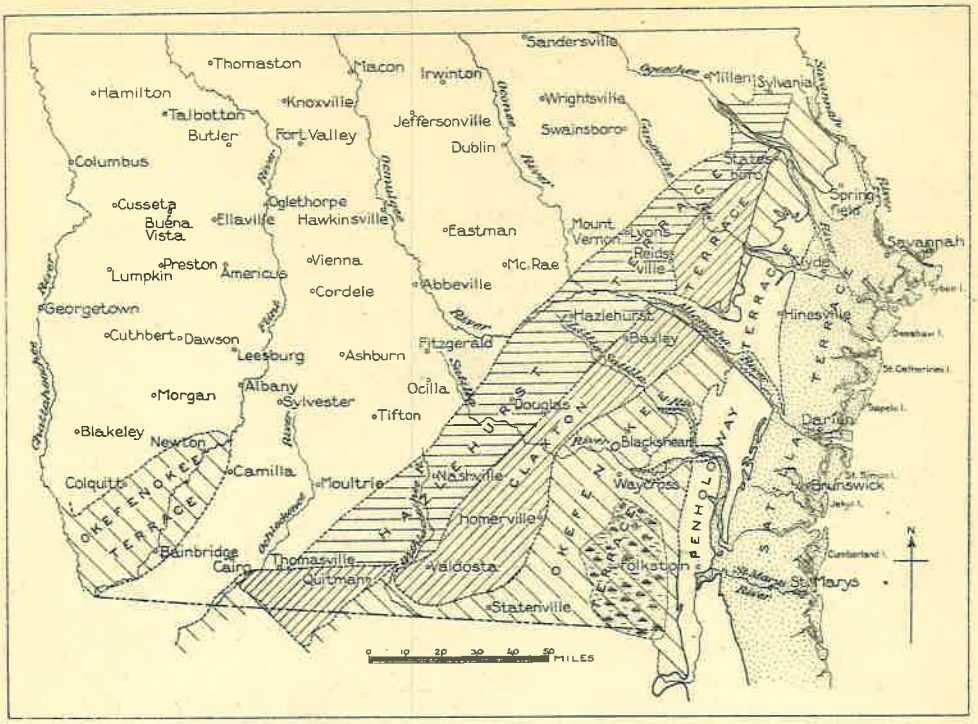
From an altitude of 240 feet above sea level at 30° N. latitude, near Starke, Florida, the crest of Trail Ridge gradually becomes lower until it reaches 166 feet two miles south of St. Marys River. For 14 miles north of St. Marys River, its crest is approximately 170 feet above sea level, and reaches 178 west of St. George. A sag 6 miles north of the latitude of St. George and a narrower sag 10 miles northwest of Homeland are only 137 and 139 feet above sea level. The crest in the intermediate region is everywhere below 160 feet.

As Trail Ridge north of Highland, Fla., is built on the outer edge of the Okefenokee terrace, its eastern side, which slopes down to the Penholoway terrace, is nearly 50 feet higher than its western. Near St. George (see Plate IX), the summit is 55 feet above the Okefenokee terrace on the west and 95 feet above the Penholoway terrace on the east. Camp Cornelia on the Okefenokee Canal is 40 feet above the plain on the west and 80 feet above the plain on the east. In the latitude of Folkston, the sides are 25 and 70 feet high. The sag 10 miles northwest of Homeland is only about 10 feet above Okefenokee Swamp and about 65 feet above the swamp on the east. The ridge west of Jesup, which appears to be the continuation of Trail Ridge, is several miles back from the edge of the Okefenokee terrace. It is only 10 feet higher than the region west of it and 35 feet higher than that to the east. Its altitude is 153 feet above sea level.

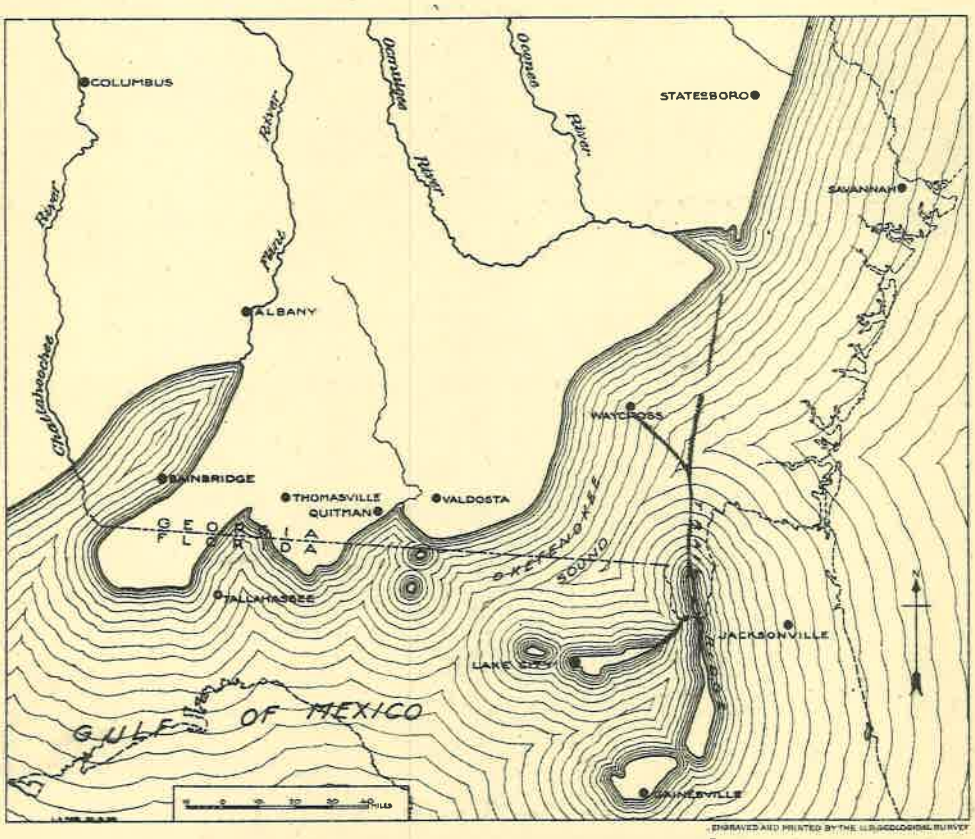
There is little difference in the steepness of the two sides of Trail Ridge. The slope averages between one foot and a foot and a half per hundred, except near the top which is gently rounded. The width of Trail Ridge in Georgia, measured between the edges of the plains on each side, ranges from 2 to 4 miles.

Because of its gentle slopes and considerable width, Trail Ridge is nowhere a conspicuous topographic feature, and would escape notice altogether in a region of greater relief. It is further obscured by the forests which clothe its sides and summit and the surrounding plains.

The greater height of Trail Ridge as viewed from the east has made erosion proceed more rapidly on that side than on the west. The inner side of Trail Ridge is ribbed with rather evenly spaced little valleys, whereas the outer side is much more irregularly corrugated. This irregularity is noticeable on Plate IX, but is more conspicuous farther north. Most of these little valleys are the normal product of erosion, and lead directly down the side of the ridge. The upper course of Cornhouse Creek, heading 10 miles north of St. George, is an exception to this rule and flows northward along the flank of Trail Ridge before turning towards St. Marys River. This stream occupies a hollow

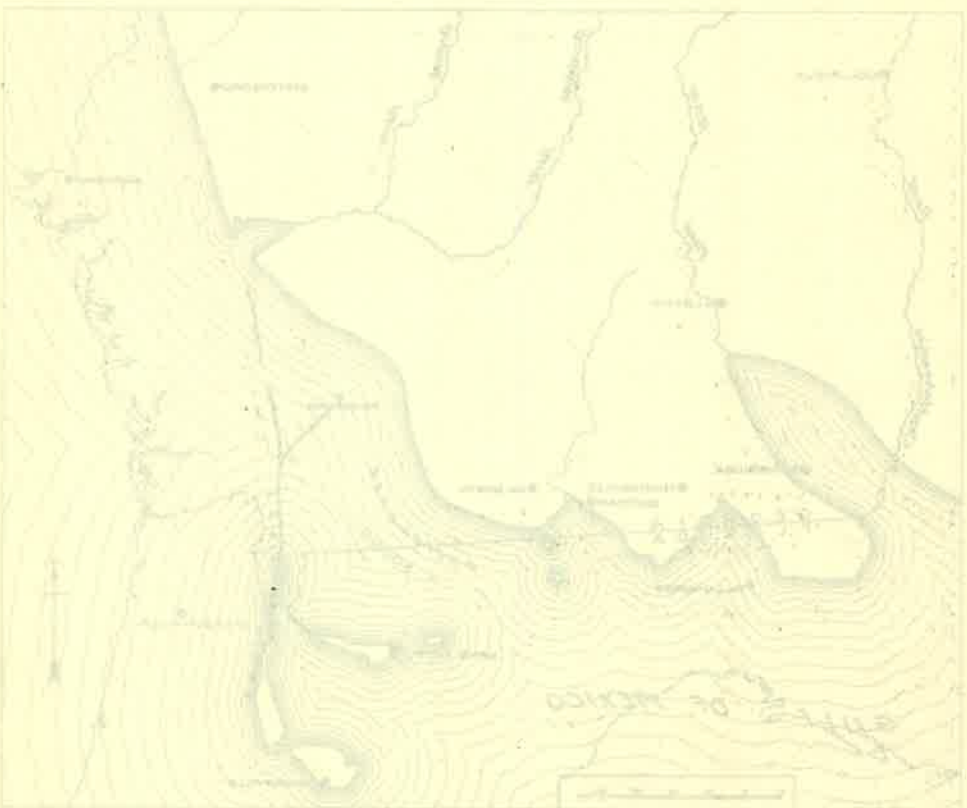


A. MAP OF THE COASTAL TERRACES OF GEORGIA



B. LAND AND SEA IN OKEFENOKEE TIME

Islands near Tallahassee and Interlachen, Fla., were inadvertently omitted



behind a spit-like projection from Trail Ridge which was probably formed when the sea covered the Okefenokee terrace. (See Plate X-B.)

CLAXTON TERRACE

The flat area shown on the topographic map of the Claxton quadrangle (Plate XI) 4 to 8 miles south of Claxton at an altitude of 180 to 200 feet above sea level, is regarded as characteristic of the Claxton terrace. Claxton, Hagan, and Bellville are built on dissected remnants of this plain. The altitude of the Claxton terrace ranges from about 160 feet above sea level at the outer margin to about 215 feet at the inner margin.

Because of the lack of topographic maps of much of southern Georgia and because much of the part that has been surveyed is considerably dissected, it is not possible here to define very precisely the limits of the Claxton terrace. In the large area between Altamaha River and the Florida line there appears to be no marked break at the boundary of the Claxton terrace and the Okefenokee terrace, and the line as shown on the map, Plate X-A, is merely provisional and no doubt will be considerably modified when new topographic maps become available. The western boundary, at the few places where it has been observed, is a low scarp.

The Claxton terrace, where not trenched by streams, is as level as any of the lower terraces. In the area south of Claxton the slope is 1½ ft. per mile toward the southeast.

Like the lower terraces, the Claxton includes much swamp land but the total area of swamp is considerably less than that of the Okefenokee terrace. Grand Bay, in Lowndes and Lanier counties, is perhaps the largest swamp on the Claxton terrace in Georgia.

The southern part of the terrace in southern Brooks and Lowndes counties, is modified by numerous sinks and ponds caused by the solution of the limestone beneath the surface, but these are neither so numerous nor so large as the ponds on the adjacent part of the Okefenokee terrace.

HAZLEHURST TERRACE

The area chosen as the type of Hazlehurst terrace is crossed by the road from Hazlehurst to Baxley. Because of the lack of topographic maps of all the region included in the terrace except a small highly dissected area east of the 82nd meridian, it is not possible at this time to give a detailed description of the Hazlehurst terrace. Its outlines, very much generalized, are shown on the map (Plate X-A). It is separated from the adjacent terrace on the east by a low scarp which probably in few places exceeds 20 feet in height. The western boundary, at least in the interstream areas, is marked by an abrupt transition to the rolling hills of the Tifton Upland.

The altitude of the Hazlehurst terrace ranges from about 215 feet at the foot of the scarp separating it from the Claxton terrace to 260 feet at the edge of the Tifton Upland. The slope from Adel to Mineola is at the rate of 1½ feet per mile toward the southeast.

CONTINENTAL SHELF

A description of the coastal terraces would be incomplete without mention of the Continental Shelf of which they were once a part.

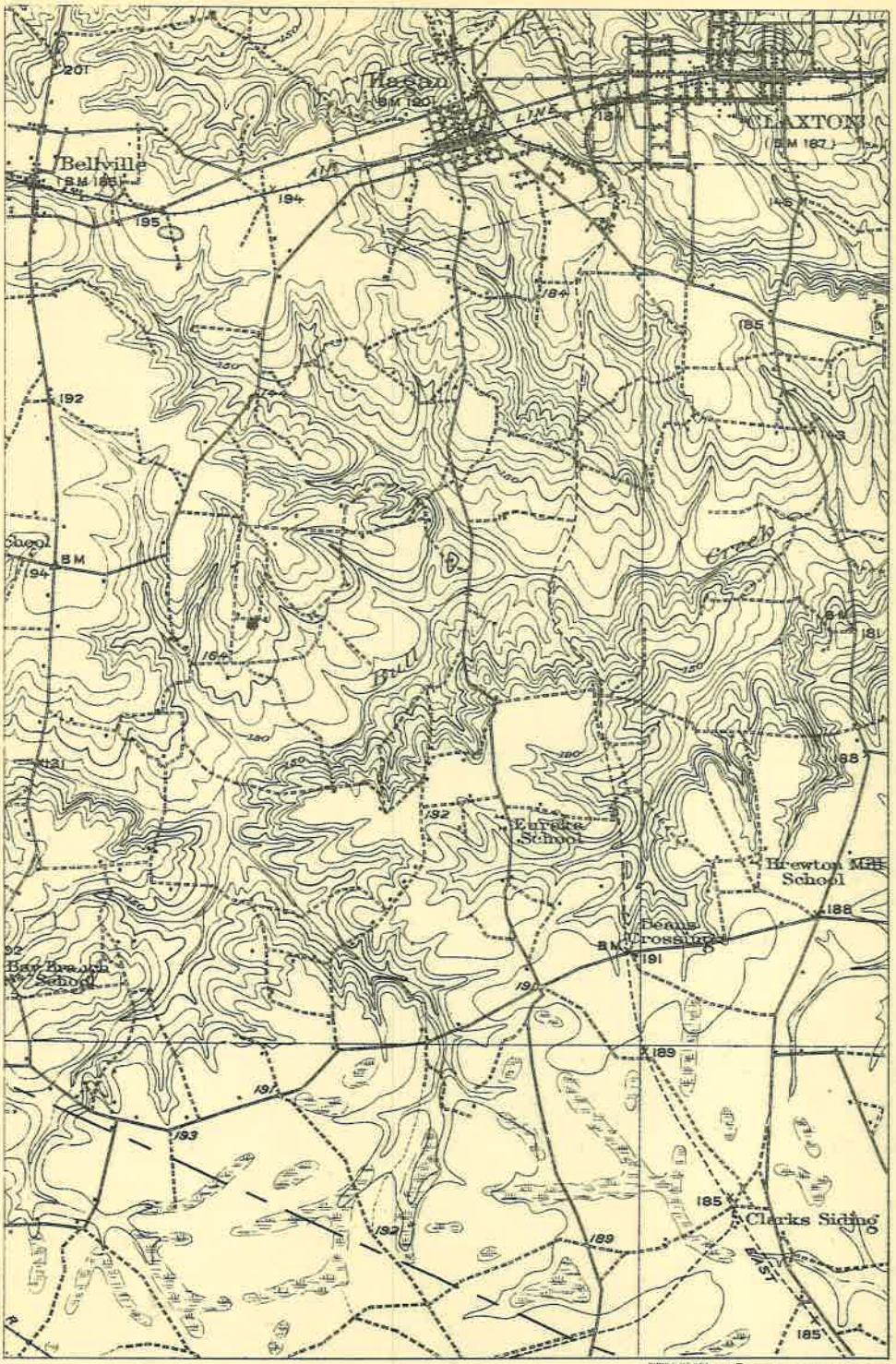
The Continental Shelf is the submerged part of the continent, and is the continuation, beneath the sea, of the Coastal Plain. Off the Georgia coast it is a platform 80 to 85 miles wide which slopes gently from sea level to a depth of about 300 feet, beyond which the bottom drops off abruptly to great depths. The outer boundary of the continental shelf is by most writers placed at the 100 fathom line—a depth of 600 feet— but off Georgia the steep slope begins at a depth of 50 fathoms or less. The 50-fathom or 300-foot contour line might more appropriately be regarded as marking the outer edge of the Continental Shelf.

Near shore the slope of the continental shelf is variable, but much steeper than off shore. Between the 5-fathom line and the 50-fathom line (30 to 300 feet), the slope is at the rate of 3.6 feet per mile. Between 10 and 20 fathoms (60 and 120 feet) the slope averages 2 feet per mile. These slopes are somewhat greater than the gradients of the coastal terraces, which average about a foot and a half to the mile, but it is natural for terraces to be flatter than the slope from which they are formed, for in their making the high parts are planed off and the lower places filled in.

ORIGIN AND DEVELOPMENT OF THE COASTAL TERRACES

The coastal terraces were formed by processes which are still continuing. Each terrace indicates a long stand of the sea at a definite altitude with respect to the land, during which the waves cut a wide or a narrow notch into the shore and with the debris from the land built up a platform in the deeper water off-shore. At the end of each such long period of stability came a time of readjustment, when the land rose or the water level fell; the shoreline retreated seaward and what had been the bottom of the ocean became dry land. The wave-cut bench, the sand bars, and part of the built-up platform were exposed to view.

A marine terrace may be defined as the part of the sea bottom uncovered and converted into land by the withdrawal of the sea from one level to a lower. The most significant factor to be taken into consideration in tracing marine terraces, therefore, is the position of the shore line before and after the period of emergence which brought each terrace above the water. As the ocean floor today is not absolutely flat, so in by-gone ages there were shoals and deeps, sand bars and deltas. The ancient sea floors exposed by the retreat of the sea show all the irregularities that they originally possessed except as they may have been modified since their emergence by the action of rain and streams. It is therefore natural that coastal terraces do not slope evenly in one direction and that there are plains or flats at differene levels with connecting slopes which are nevertheless part of the samt terrace. It also follows that a slight emergence would produce a mor



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Part of the Claxton sheet

THE CLAXTON TERRACE NEAR CLAXTON

Scale $\frac{1}{62500}$

1 ½ 0 1 2 Miles

Contour interval 10 feet

Datum is mean sea level

irregular shore line than a greater emergence, for the sea bottom is usually more uneven in shallow water near shore than in deeper water.

During the time when the Hazlehurst terrace was being formed, the Coastal Plain of Georgia stood about 260 feet lower than now. The shore line ran from somewhere near Thomasville through Alapaha and Sylvania. All of the peninsula of Florida was probably under water, and a bay of unknown size probably reached far northward into the Chattahoochee-Flint River basin. The waves of the Hazlehurst sea beat upon the sandy shore of the Tifton Upland.

As time passed, the land emerged about 45 feet. The shore line then stood about 215 feet above present sea level, and the Hazlehurst terrace separated the Tifton Upland from the sea.

The next emergence, about 55 feet, reduced the shore line to an altitude only 160 feet above present sea level. (See Plate X-B). A fringe of land, the Claxton terrace, was added to the mainland, and a group of islands appeared above the sea on the Floridian plateau. From Lake City, Fla., a long, narrow island 40 feet high at places extended eastward along the present course of the Seaboard Air Line Railway nearly to Sanderson, about 25 miles and continued northeastward as a submerged bar to St. Marys River. Another island containing about 125 square miles lay north of Gainesville, Fla. A third island, in the southeastern part of Bradford County and the adjacent part of Clay Co., Fla., formed the southern termination of Trail Ridge, which extended northward as a sand spit as far as the Seaboard Air Line Railway east of McClenny. North of the railroad the Trail Ridge spit continued as a chain of long, low, narrow islands rising from a bar which was completely submerged or awash beyond a point 5 miles north of St. George, Ga., and probably joined the mainland near Beards Creek. The Trail Ridge bar appears to have been constructed of sand transported northward by ocean currents from the Florida islands and dropped at the edge of slack water.

Back of Trail Ridge bar lay a large body of shallow water to which the name Okefenokee Sound (see Plate X-B) may appropriately be applied. Okefenokee Sound was partly protected from the open ocean on the south by Lake City Island and several smaller islands in line with it. In size and shape Okefenokee Sound with its protecting bars and islands closely resembled the present Pamlico Sound of North Carolina. The water at the southern entrance to Okefenokee Sound between Lake City Island and the mainland, was everywhere shallow, and probably in few places exceeded 20 feet in depth. The water over the present Okefenokee Swamp was about 40 feet deep.

The shore of the mainland adjacent to the Okefenokee Sound was low and shelving like that back of Pamlico Sound, but farther north the water was a little deeper and the land a little higher. Near Brooklet, the land rose 30 to 40 feet within half a mile of the shore and the bottom sloped down to an equal depth within a mile or two before flattening out to the nearly level plane of the ocean floor.

The next event in the history of southern Georgia was further emergence of about 60 feet, which left the water line only about 100

feet higher on the land than the present sea level. As the land emerged, the water of Okefenokee Sound, held back on the east by the Trail Ridge barrier, found a partial outlet to the southwest near White Springs, Fla., but could not all escape at once because the bottom of the sound was lower than any part of its rim. Suwanee River, born of the overflow from Okefenokee Sound, is cutting through the rim and may eventually drain even the more remote parts of Okefenokee Swamp.

After the Okefenokee terrace had emerged from the water but still remained about 100 feet nearer sea level than now, the shore lay along the eastern flank of Trail Ridge from Florida to an embayment at the mouth of Satilla rivers (see Plate X-A). North of this point the shoreline was very crooked because the ocean floor before its emergence was uneven. This irregularity of the sea bottom may perhaps be attributed partly to the nearness of three large rivers—the Altamaha, the Ogeechee, and the Savannah—which had built up banks and bars similar to those forming today off the mouths of these same rivers, and partly to the absence of currents strong enough to smooth off the irregularities.

The next period of emergence raised the land only 30 or 40 feet and left the outer edge of the Penholoway terrace awash. The old shore lines of that time now stand 60 or 70 feet above sea level. This position of the sea level lasted long enough for a series of barrier ridges, bars, and islands to be built up in the shallow water near shore (south of Altamaha River) and for an intricate system of salt marshes to form behind them. Satilla River, finding its direct course to the sea obstructed by a wave and current built bar, turned southward along a lagoon until its waters, united with those of the northwardly deflected St. Marys, succeeded in keeping open an outlet to the ocean. This ancient estuary of Satilla River has its modern analogue in Winyah Bay and Waccamaw River of South Carolina. The coast north of Altamaha River was swept by more powerful currents which carried away the sand as fast as it was torn loose by the waves and prevented the formation of bars and islands. The shore line at the close of this period and before the uplift which laid bare the Satilla terrace was strikingly like the present cuspate coast of the Carolinas. The narrow terrace along the edge of the Satilla-Penholoway escarpment between Hinesville and Canoochee River at an altitude of 40 to 50 feet above sea level is probably a wave-cut platform formed at this time. Cherokee Hill, northwest of Savannah, possibly is of similar origin (topographic maps are lacking) but its isolation and its nearness to Savannah River suggest that it more probably was a bank formed of sediment dropped by the river.

The next emergence, about 60 feet, brought the sea level to its present position and laid bare the Satilla terrace. The shore line resulting from this latest emergence, was very irregular because of the many low, delta-like banks or shoals that had ribbed the sea floor during the preceding epoch. Under the combined action of waves, winds, and currents, a series of sand bars began to form off shore, rapidly grew into islands, and formed a new, straighter shore line. The little bays that indented the old shore line and the lagoons back of the islands,

shut off from the force of the waves, immediately began to fill with silt. Mud and sand brought down by the streams or stirred up from the bottom by storms settled in the quiet water of the bays and lagoons. As soon as the water grew shallow enough for grasses to take root, vegetation converted the tidal flats into marshes and furthered the accumulation of silt. Tidal movement became restricted to definite channels which the great volume of water, rushing in or out four times each day, kept clear of sediment and scoured to depths of more than 20 feet. Intricate and complete drainage systems for each little subarea of marsh became established. Thus were formed the Sea Islands and the Marshes of Glynn.

CORRELATION OF THE COASTAL TERRACES

Correlation of the marine terraces in Georgia with those in other regions is difficult and uncertain because the terrace systems in the adjoining states have not been studied in sufficient detail. Before 1917 little progress could be made in the study and interpretation of terraces because so little of the area was adequately mapped. Although many new maps are now available, many critical areas still remain unsurveyed.

Terraces in Florida are very imperfectly known. Matson[1], in 1913, briefly described three terraces which he called *Newberry terrace,* 70 to 100 feet above sea level; *Tsala Apopka terrace,* 40 to 60 feet; and *Pensacola terrace,* less than 40 feet above sea level. The Newberry terrace is probably equivalent to the Penholoway terrace. The Tsala Apopka terrace and the Pensacola terrace, if the limits of altitude assigned to them by Matson are correct, probably are together equivalent to the Satilla terrace of Georgia. The terraces recognized in Georgia, at least those below the Claxton, can be traced southward into Florida on the new maps to Latitude 30° N., and westward to longitude 82° 15′.

Little has been published about the marine terraces in South Carolina. Studies in progress by the writer indicate that conditions there are similar to those in Georgia. The inner margin of the well preserved terraces lies at an altitude of approximately 215 feet above sea level.

The altitudes of the terraces in North Carolina tally remarkably well with those of Georgia. Stephenson[2] recognizes five terraces, as follows: Pamlico, 0 to 20 feet; Chowan, 30 to 60 feet; Wicomico, 60 to 100 feet; Sunderland, 100 to 160 feet; and Coharie, 160 to 235 feet above sea level. The Pamlico and Chowan, together, fall within the limits of the Satilla terrace; the altitudes of the Wicomico correspond exactly with those assigned to the Penholoway; the Sunderland agrees with the Okefenokee; and the Coharie is only a little higher than the Claxton. B. L. Johnson[3] found remnants of a higher terrace in North Carolina, at altitudes from 220 to 260 which corresponds closely with the

1. Matson, G. C., Geology and ground waters of Florida: U. S. Geol. Survey Water-Supply Paper 319, pp. 31-35, 1913.
2. Stephenson's conclusions have been summarized by W. B. Clark in The Physiography of the Coastal Plain of North Carolina: North Carolina Geol. Survey vol. 3, Chapt. 1, pp. 27-31, 1912.
3. Science, new series, vol. 26, pp. 640-642, 1907.

Hazlehurst terrace of Georgia. Another terrace, 280 to 320 feet above sea level, noted by Johnson, is probably developed near Portal and Woodcliff, in Bullock and Screven counties, Georgia.

The terraces in North Carolina designated Wicomico and Sunderland were so called because of their supposed equivalence to terraces so named at approximately the same altitudes in Maryland. In the present report, these names are not applied to the terraces in Georgia because of the possibility that the names were wrongly used in North Carolina. The geological history of the Coastal Plain in Maryland, as interpreted by Shattuck[1] and others, differs materially from the writer's interpretation of the events that happened in Georgia. In Maryland there seem to have been repeated oscillations of sea level which shifted the strand line alternately back and forth across the Coastal Plain. Comparatively recent submergence of this region is suggested by the fact that tide water extends up the drowned valleys of all the larger rivers beyond the inner edge of the Coastal Plain and for some miles into the Piedmont. South of Hatteras the movement was dominantly emergence, interrupted by periods of quiescence. Submergence, if any occurred, was on a small scale and did not produce conspicuous effects. Coast charts show no submerged river channels south of Hatteras like the gorges that furrow the continental shelf off the mouths of the northern rivers. Ancient shore lines now at the same level in Maryland and Georgia may not be contemporaneous.

The Pamlico and Chowan terraces of Stephenson and Clark, as already noted, fall within the limits of the Satilla terrace as redefined in this volume. That there are extensive flats at the altitudes assigned to these supposed terraces can not be questioned, nor will the student of maps deny that there are other flats at intermediate levels. In the opinion of the writer these various flats represent merely inequalities in the level of the ocean floor corresponding to a single position of the sea—one shore line, different depths of water. Some of these flats may be benches cut by the waves beating against the mainland; others may be the remains of islands planed off by the sea; still others may be banks built up from a lower level; but all were formed at various depths in one sea while it stood at a constant level.

The names of the terraces in Georgia, Florida, and North Carolina and the altitudes assigned to them by Matson, Stephenson, and the writer, are shown in the following table:

1. Shattuck, G. B., Maryland Geol. Survey, Pliocene and Pleistocene, 1906.

Correlation of Marine Terraces

Florida Matson, 1913	Georgia Cooke, this book	North Carolina Stephenson, 1912
	Hazlehurst (260-215)	Unnamed (260-220)
	Claxton (215-160)	Coharie (235-160)
	Okefenokee (160-100)	Sunderland (160-100)
Newberry (100-70)	Penholoway (100-60)	Wicomico (100-60)
Tsala Apopka (60-40)	Satilla (60-0)	Chowan (60-30)
Pensacola (40-0)		Pamlico (20-0)

RIVER TERRACES

Terraces are not confined to the coastal region. All of the larger streams of the Coastal Plain are bordered by at least one terrace, and many have several at different levels. A river terrace may be defined as the old floor of a valley within which an inner valley has been cut by the stream when deepening its channel. River terraces are fossil flood plains. River terraces differ from marine coastal terraces in several respects. Coastal terraces have an upper limit of altitude determined by the height of the water in the sea or lake. The force of the winds and waves can cut or build a terrace only a few feet above normal water level. River terraces, on the contrary, have a lower limit of altitude determined by the bed of the stream, below which they can not be cut. The limit of altitude of a coastal terrace is a level surface; but the base to which a river terrace approaches rises gradually up stream, being the grade of the flood plain of the stream at the time when the terrace was formed.

Rivers tend to cut their valleys down to a definite base level. This base may be an ocean, bay, or lake; it may be a mill pond or reservoir; or it may be any natural or artificial obstruction such as a ledge of rock in the channel which retards the wearing away of the bottom. If, after the lapse of considerable time, the obstruction is removed or the level of the lake is lowered, the stream flows faster, cuts a narrower valley in the floor of the old, and leaves its former bottom land above the reach of floods. Who has not seen this phenomenon on a small

scale in the trenching of the silt in an old mill pond after the dam is broken?

The presence of terraces far above high water mark does not indicate, as one might at first suppose, that the ancient river which formed them was any larger than the modern stream. The ancient river flowed in a shallow valley; the modern river flows in a deeper valley. The volume of water may have remained the same.

Along every large river of southern Georgia are remnants of river terraces corresponding to the marine coastal terraces. Each river terrace starts at the altitude at which the sea stood when the corresponding marine terrace was formed and rises gradually up stream. It has not been found practicable to map these river terraces in detail, but a few of the more conspicuous localities where they may be seen will be cited.

Along the Chattahoochee the first terrace above the ordinary flood plain stands at an altitude of 50 or 60 feet above normal water level. It is popularly known as the "second bottom." The down-town part of the City of Columbus is built on this terrace.

The next higher well developed terrace, about 130 feet above the river, can be seen along the Macon Road one-quarter of a mile to a mile and a half east of the railroad yards at Columbus. Georgetown and Fort Gaines are built on this terrace.

A third terrace, 160 to 170 feet above the river, is well developed on the Georgia side of Chattahoochee River below Upatoi Creek. The road from Columbus to Lumpkin crosses this terrace.

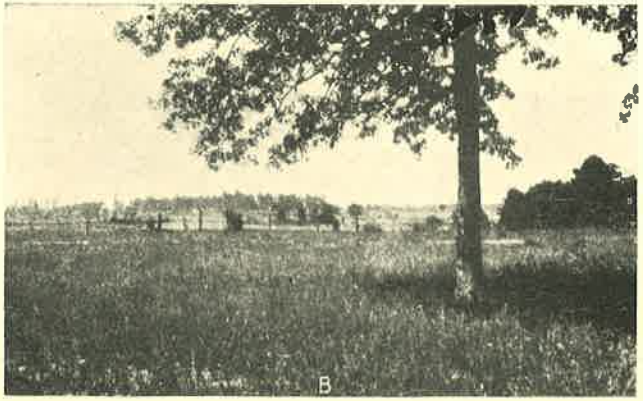
Terraces along the Ocmulgee are not so well developed as along the larger rivers. At Macon the flood plain or first bottom is about 20 feet above low water. It fringes the river at East Macon. Central City Park is built on the second bottom, but is probably within reach of very high floods. The business section of Macon occupies a natural amphitheater which slopes gently down from First Street to an altitude of about 55 feet above low water mark at the Terminal Station. Hawkinsville, slightly more than 50 feet above the river, is probably built on the same terrace as the down-town part of Macon.

The most prominent terrace on Oconee River lies at an altitude of 50 or 60 feet above the present flood plain. It is well shown in Washington County between Bluff and Gum creeks.

A large part of the City of Augusta is built on the second bottom of Savannah River at an altitude of 50 or 60 feet above the water, and this terrace continues for several miles below Augusta. For a long distance below the mouth of Spirit Creek the flood plain of Savannah River lies at the foot of a steep bluff which leads directly to the upland, but the intermediate terraces are well developed across the river, in South Carolina.

TIFTON UPLAND

The Tifton Upland forms a strip about 45 miles in average width extending across the middle of the Coastal Plain from the southwestern corner of the State northeastwardly to Waynesboro, a distance of about



Photographs A. and B. by Wythe Cooke; C. and D. by S. W. McCallie.

A. POND ON THE DOUGHERTY PLAIN AT DUDLEY, LAURENS COUNTY.

B. TIFTON UPLAND TEN MILES NORTH OF EASTMAN.

C. FALL LINE HILLS 8 MILES WEST OF LUMPKIN.

D. OUTCROP OF SANDSTONE IN THE TIFTON UPLAND, JEFF DAVIS COUNTY.

240 miles. Its southeastern boundary, separating it from the coastal terraces, is a nearly straight line passing a few miles east of Thomasville, Vidalia, and Sylvania. Its northwestern boundary is much more irregular. Between Chattahoochee, Fla., and Cordele, the boundary between the Tifton Upland and the Dougherty Plain is a well-defined westward-facing escarpment. West of Climax (alt. 279) the drop to the Dougherty Plain is 140 feet. East of Acree it is 100 feet. Between Cordele and Waynesboro the Tifton Upland merges into the Dougherty Plain and the Louisville Plateau.

The traveller on the Tifton Upland receives the impression of gently rolling hills, broad, rounded summits, no marked parallelism of ridges, and smoothness of configuration (see Plate XII-B). Few gullies like those in the Fall Line Hills are to be found. Near the larger rivers slopes are steeper and even precipitous, but the steep slopes do not extend far back. The areas between the streams tend to be broad rolling plains which break into irregular ridges. Plate XII-D shows an unusually rugged part of the upland.

As topographic maps are lacking in the Tifton Upland except in the extreme northeastern end, few details can be given. In Jenkins County altitudes range from 120 feet above sea level on Ogeechee River to 360 feet on the highest hills, a maximum relief of 240 feet, but ordinary hills are about 100 feet high. North and west of Millen is a flattish area averaging 200 feet above sea level in which the presence near the surface of beds of limestone is shown by many shallow sinks. (See Plate XIII). Magnolia Spring and other springs issue from this rock. This flat area extends northward as far as Perkins and westward on both sides of Ogeechee River about to Midville.

The following description of Dodge County, most of which lies within the Tifton Upland, is quoted from the Soil Survey by Ely and Griffin [1]:

> In a general way the topography of Dodge County is that of a gently rolling plain, cut by sluggish streams with only moderate slopes along their courses. Ultimately the drainage of nearly the entire county flows into Ocmulgee River, but in the northeastern part of the county the waters enter several good-sized tributaries before entering the larger stream. The Little Ocmulgee River, or "Gum Swamp," as it is popularly known, passes through the county in a generally southeast direction, a few miles to the northeast of its center. Waltons Creek enters this stream some six miles north of Eastman. Sugar Creek—a stream rising within the county—is only a few miles southwest of these streams, and flows in the same general direction. These three, with their tributaries, drain nearly all the central, northeastern, and southeastern parts of the county. All the streams, except the Ocmulgee River, are characterized by narrow bottoms entirely covered with water during most of the winter and other rainy seasons. In summer the streams dry up to such an extent that the current entirely ceases, and the stream course is marked only by pools. For a great part of their length on each side of the present bottoms wide, flat or very gently rolling areas of sand are seen. On the edge of these the land rises, usually gradually, but sometimes abruptly, from 30 to 60 feet.
>
> A more or less prominent ridge separates the waters of Sugar Creek from those of the Little Ocmulgee River. The Southern Railway runs along the crest of this ridge, and Eastman, Chauncey, and Empire are situated thereon.

[1] Ely, C. W., and Griffin, A. M., Soil Survey of Dodge County, Georgia: Field operations of the Bureau of Soils, 1904, pp. 233-234, 1905.

Eastman is 361 feet and Chauncey 300 feet above sea level. Similar ridges frequently occur between the smaller streams. The crests of these ridges are covered with Norfolk sandy loam and the slopes with the Norfolk sand, and their location can be made out on the soil map from this circumstance.

To the southwest of Sugar Creek a divide, somewhat similar in character to the one just described, separates the waters which enter the Ocmulgee River from those which flow to the southeastward. This ridge is not so pronounced as the others, but is more like a gently rolling plain of higher land, with ridge-like outliers extending down between the streams. Beyond this the drainage is to the southwest. In some places at the edge of this divide, facing the river or its tributaries, even the smaller streams have cut V-shaped channels 40 to 60 feet deep, and some of the most hilly land in the county is seen here. Nearer the river the land becomes gently rolling again, with shallow stream courses. A flat, low-lying deposit of sand, similar to that found along the other streams, occurs near the river and the bordering bottom lands. In the vicinity of Rhine this flat land widens out up the creeks, and there is a slight rise near the river of 10 to 20 feet. The upland always meets the bottom land in a gentle slope, and even where it extends to the river bank in few places is it over 15 or 20 feet above the bottoms.

An area in Telfair and Wheeler Counties extending for several miles in all directions from Scotland is described by Hull and Teas [1] as follows:

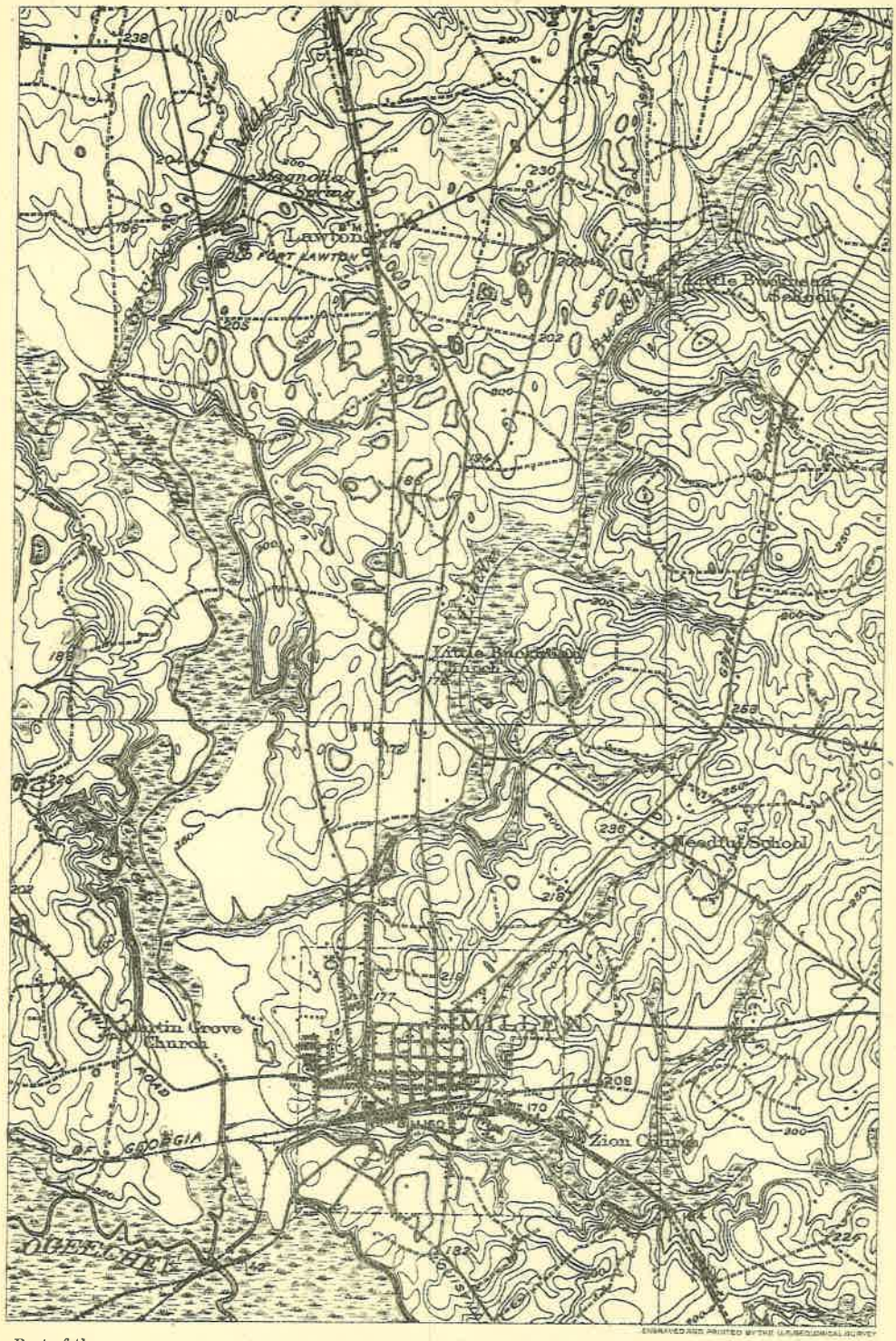
The topography is characterized by gently rolling hills that are generally not higher than 50 or 60 feet above stream level. The surface of the plain slopes southeastward at a rate not less than 4 feet per mile. Streams flow sluggishly southeastward in meandering courses through broad shallow valleys. The maximum relief of the area is probably less than 150 feet. Each of the three rivers, Oconee, Little Ocmulgee, and Ocmulgee, is bordered in places by distinct terrace plains, one 10 to 20 and the other 40 to 50 feet above low-water level. Northeast of Little Ocmulgee River is a belt of sand hills in places 1½ miles wide and as high as 50 to 75 feet above stream level.

Ben Hill County, which, with the possible exception of the southeast corner, lies wholly within the Tifton Upland, is described as follows by the soil surveyors: [2]

Ben Hill County embraces three distinct topographic divisions. The first is the "flatwoods," which occurs along the southern boundary of the county east of Ashton School, continuing with an average width of somewhat more than a mile, with the Broxton road as its approximate northern boundary for the entire distance. Another small area of "flatwoods" occurs along the eastern county line, about a mile from the southeastern corner, and also smaller areas 2 or 3 miles east of Fitzgerald. The next topographic division is the undulating to gently rolling country found in the southern part of the area, usually surrounding the "flatwoods," in many cases the change from one to the other being very gradual. It extends north from Fitzgerald a distance of 2 to 3 miles. In the western part of the county, where the drainage is toward the Allapaha River, this undulating to gently rolling country occupies the greater portion of this section. It extends east across the divide, where the drainage is in the other direction, and toward the Ocmulgee.

The largest portion of the county is included in the rolling to rough and hilly country in the northern part of the area. There the drainage is toward the Ocmulgee River. A striking feature of this section is the large number of streams which pass through it, forming a complete and very intricate drainage system. Where this rolling to hilly country joins the undulating section there is usually a more or less distinct escarpment from 25 to 50 feet in height. Streams

1. Hull, J. P. D., and Teas, L. P., A preliminary report on the oil prospect near Scotland, Telfair County, Ga.: Georgia Geol. Survey, p. 2, 1919.
2. Higgins, A. L., and Long, D. D., Soil Survey of Ben Hill County, Ga.: Field operations of the Bureau of Soils, 1912, pp. 496-497, 1915.



Part of the Millen sheet

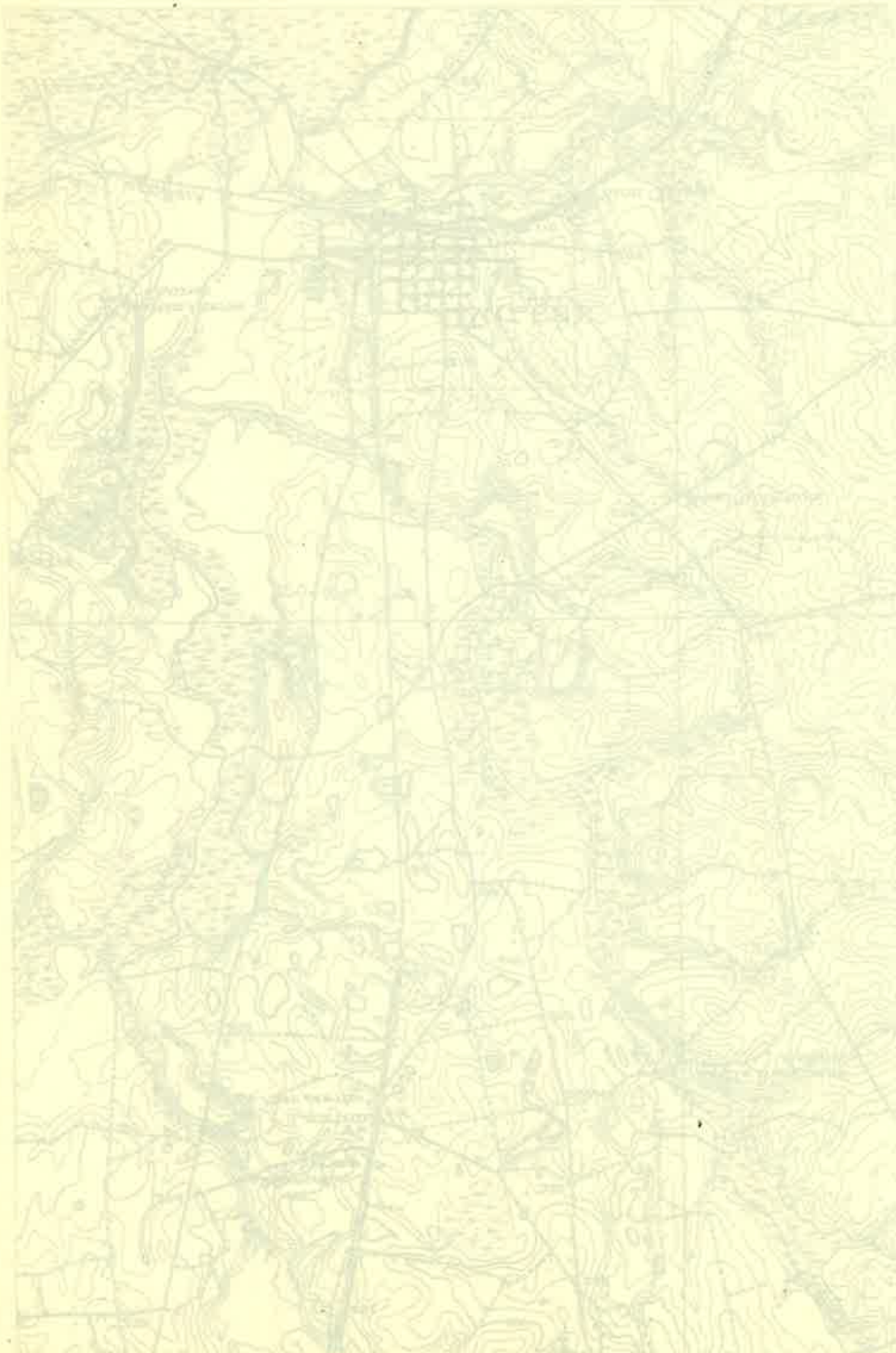
THE TIFTON UPLAND NEAR MILLEN

Scale 62,500

0 ½ 1 2 3 Miles

Contour interval 10 feet

Datum is mean sea level



that flow through the gently rolling area head on the very brink of this escarpment, the country above it being nearly level. Occasionally a stream has cut back through the bluff and drains some distance back in the more level section, but such cases are rare. A peculiar and very noticeable feature is the occurrence of amphitheater-like excavations about the heads of streams which rise below the escarpment. This feature is common all through this rolling to broken area, especially where it is roughest.

In this section the topography is so rolling that erosion has been extensive and interferes greatly with farming operations. Leaching is also injurious to crops in this section, particularly when fertilizers are applied to the soil.

The streams throughout the county have generally small strips of bottom land along their banks, varying in width from a few rods to a quarter of a mile or more, as along House and Stergeon Creeks. The streams usually head in areas of wet lowland, the bottoms proper developing and widening downstream, where the drainage channel becomes better defined. In the rougher section of the county the limits of the bottom lands are clearly defined, although there is no pronounced bluff. In the more level areas the rise from the bottoms is so gradual that the difference in soils determines their outlines rather than any topographic difference. The bottom lands of all the larger creeks are subject to overflow in times of heavy rainfall and their channels as a rule are not distinct, the streams having a tendency to meander over the lowland. Along the Ocmulgee there is a fairly large area of bottom land, or "river-swamp," as it is known locally, averaging from a quarter of a mile to a mile in width, although for some distance along the border of the county the river follows the southern bluff, the swamp being all in the county to the north.

The elevation of the county is about 300 feet above sea level at Fitzgerald, and slightly higher to the north.

Sinks and ponds are not uncommon in the Tifton Upland. Besides those already mentioned in the vicinity of Millen, they are especially numerous in the southern half of the Upland. They are circular, elliptical, or elongated depressions varying from less than an acre to many acres in area. Most of them are shallow and thickly overgrown with cypress and other water-loving trees. Several good-sized ponds are found in Turner County. Colquitt County contains many small ponds and "bays." The deep lime sinks of northwestern Grady are well known.

The soils of the Tifton Upland are chiefly gray sand with clay subsoil. The entire region formerly supported a superb growth of open pine woods carpeted with wire-grass which afforded pasturage for many cattle. Most of the land has now been cut over and part of it is under cultivation. Cotton and corn are the principal crops. Much sugar cane is grown. Canteloupes, watermelons, and tobacco are raised in considerable quantity, and pecan groves are increasing in number.

Much of the Tifton Upland has been settled only recently, and parts of it still have a sparse population. Thomasville, one of the oldest towns, is a fashionable winter resort. Other growing towns are Cairo, noted for its production of cane syrup, Moultrie, Tifton, Sylvester, Ashburn, Ocilla, Fitzgerald, Abbeville, McRae, Eastman, Mount Vernon, Swainsboro, Wrightsville, Millen and Sylvania.

LOUISVILLE PLATEAU

The Louisville Plateau extends eastward from Oconee River to Savannah River, a distance of about 90 miles, and lies between the Fall Line Hills and the Tifton Upland. Its maximum width is about

20 miles. Its outlines are determined, in large part, by the areal distribution of brilliant red sand[1] which contrasts with the gray or yellowish sand that forms the surface of the Tifton Upland[2]. The plateau is typically developed on the divide between Big Creek and Duhart Creek in Jefferson County between Louisville and Stapleton. It is characterized by wide flat areas which slope gently southward at a rate of about ten feet per mile. The altitude of the upland surface ranges from about 500 feet above sea level near Stapleton to about 320 feet near Louisville. Brier Creek near Waynesboro and Rocky Comfort Creek near Louisville have cut their valleys 100 feet below the upland. Near the northern edge the plateau is considerably dissected, and its separation from the adjoining Fall Line Hills is not precise. Part of the Louisville Plateau is shown in Plate XIV.

The staple products of the red sandy soils of the Louisville Plateau are cotton and corn. The principal towns are Louisville, Sandersville, and Gibson. Waynesboro lies partly on the Louisville Plateau and partly on the Tifton Upland.

DOUGHERTY PLAINS

The Dougherty Plain receives its name from Dougherty County. It extends from Chattahoochee River to Oconee River, and lies between the Fall Line Hills and the Fort Valley Plateau on the northwest and the Tifton Upland on the southeast. (See Fig. 2.) It adjoins the Louisville Plateau on the east.

Starting on Chattahoochee River at the mouth of Cohelee Creek, 80 miles south of Columbus, the boundary follows the divide between the waters of Chattahoochee River and Flint River to Richland, zigzags north of Americus and south of Perry to Ocmulgee River, circles northward to Dry Branch and down Big Sandy Creek to Oconee River, down the Oconee below Dublin, westward to Cochran, southward to Abbeville, circles near Pinehurst to Cordele, and thence in a broad curve east of Camilla and Bainbridge to the Florida line at Chattahoochee. This area embraces the entire drainage basins of Spring Creek and Ichawaynochaway Creek as well as the greater part of the basins of the other tributaries of the lower Flint, an area of nearly 7000 square miles.

The Dougherty Plain, as the name implies, is nearly level. It is not, however, a single plain, but is more complex, and could be divided into several units if detailed topographic maps were available. The plain slopes from nearly 600 feet above sea level along the northwestern border southeastward to about 160 feet at the foot of the Tifton Upland. The lowest point is at the mouth of Flint River, which is about 50 feet above sea level. The slope from Kimbrough (altitude 558 feet) to Camilla (altitude 167) is at the rate of about 6½ feet per mile.

The northwestern part of the Dougherty Plain is rolling, but even in this region, where long gentle slopes are the rule, the wider areas between the streams are very flat. Such flat areas are common in Sumter County.

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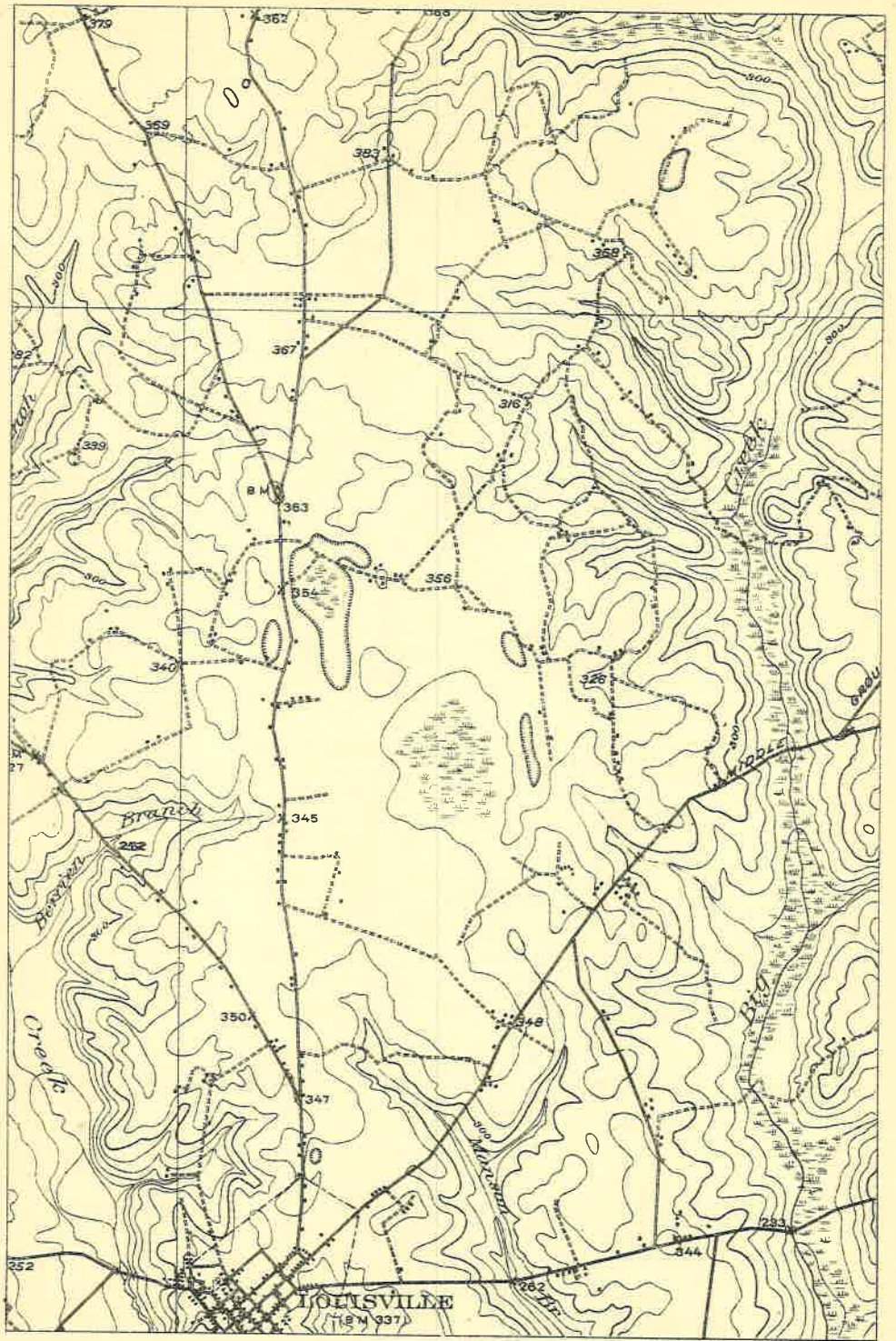
[1] Barnwell formation, of upper Eocene age, see table of geologic formations, P. 6.
[2] Alum Bluff group, of Miocene age.



ENGRAVED AND PRINTED BY THE U.S. GEOLOGICAL SURVEY

Part of the Stapleton sheet

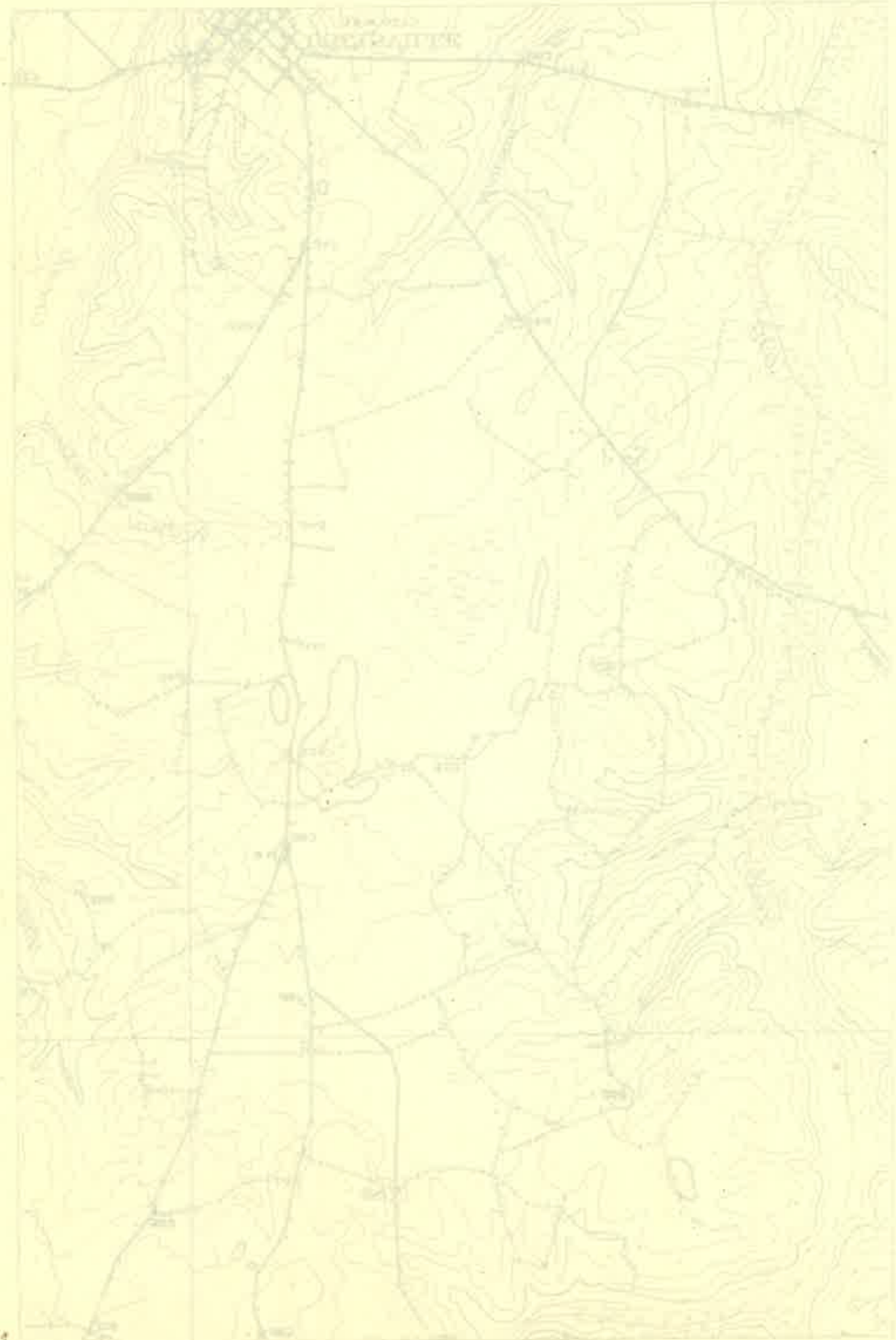
THE LOUISVILLE PLATEAU NEAR LOUISVILLE

Scale $\frac{1}{62500}$

1 ½ 0 1 2 Miles

Contour interval 20 feet

Datum is mean sea level



In the large area lying for the most part west of Flint River where limestone forms the country rock, the surface is even flatter than elsewhere in the Dougherty Plain, but the monotony of flatness is relieved by many shallow, saucer-shaped sinks or depressions of all sizes up to many acres in extent. (See Plate XII-A). Most of these sinks are nearly circular, flat-bottomed, and with gently sloping sides. They have been formed by the collapse of caverns in the soft, soluble limestone. Some of them contain large jagged lumps of flint or silicified limestone. Some of the depressions hold water all the year around, but many are dry except in rainy weather. Most of the drainage in this part of the Dougherty Plain is subterranean. There are very few small streams. Rainwater falling on the sandy surface rapidly sinks and finds its way through underground channels in the porous limestone to issue as beautiful blue springs along the banks of the larger creeks and rivers.

Included in the area described as the Dougherty Plain is an embayment of the Okefenokee terrace (see page 22) which extends up the Chattahoochee-Flint River basin a considerable distance and includes most of the area standing below 160 feet above sea level. The precise limits of this embayment are not known, but the boundary probably runs from Donaldsonville northwestward past Colquitt, crosses Flint River in the neighborhood of Baconton, and swings southward past Camilla to the edge of the Tifton Upland. It is also altogether likely that detailed maps will show fringes of Claxton and Hazlehurst terraces bordering the Okefenokee embayment and extending inland almost to Blakely and Leesburg.

The most distinctive soils of the Dougherty Plain are black clay loams derived from limestone and orange or red gravels, sands, sandy loams, and clay loams. Lumps of flint[1] are distributed over most of the area. Sinks and other poorly drained depressions contain black carbonaceous soil.

Albany, the metropolis of the Dougherty Plain, is an important railroad and distributing center and a great pecan and peanut market. Other important large towns are Americus, Bainbridge, Cordele, Cuthbert, Dawson, Dublin, and Hawkinsville. Camilla is a center of canteloupe production.

FORT VALLEY PLATEAU

The Fort Valley Plateau occupies an area of about 300 square miles between Flint River and Ocmulgee River in Houston, Crawford, and Macon Counties. It adjoins the Fall Line Hills on the west, north, and northeast, and the Dougherty Plain on the southeast and south. On the west it terminates in a rather steep descent of about 300 feet to the valley of Flint River. From the edge one can look westward for miles across the valley through the blue haze to the distant hills. The slopes on the north and northeast are somewhat less abrupt. The southeastern boundary is marked by the slopes of Ross Hill and Mossy Hill, which rise about 175 feet above Mill Creek.

1. The flint or silicified limestone is derived from the Glendon formation and Ocala limestone, which underlie the Dougherty Plain.

The City of Fort Valley, from which the plateau takes its name, stands at an altitude of 522 feet above sea level. The plateau is nearly flat, but slopes gently southeastward. Its western rim is the divide between the drainage of the Gulf of Mexico and the Atlantic Ocean. The plateau itself drains southeastward through Mossy Creek and Big Indian Creek into Ocmulgee River. These creeks have cut well into the plateau and show wide terraces along their lower courses. The plateau is capped by a thin veneer of brilliant red sand but the underlying light colored sands and kaolin are visible in many natural exposures.

The prevailing soils of the Fort Valley Plateau are gray or yellow loams with brick red sandy clay subsoil. The most important agricultural product is the peach, which has given its name to Peach County. The largest peach orchards in the world are on the Fort Valley Plateau.

Fort Valley, Perry, and Marshallville are the largest towns.

FALL LINE HILLS

The Fall Line Hills lie immediately south of the Central Upland. They extend entirely across the State, from Savannah River to the Chattahoochee. On the south, or rather southeast, they adjoin the Dougherty Plain and the Fort Valley and Louisville plateaus. The Fall Line Hills vary in width from a maximum of 80 miles along the Chattahoochee to a minimum of three or four miles east of Flint River (see Figure 2, page 18).

The northern or inner boundary of the Fall Line Hills is a sinuous line passing through Columbus, Macon, and Augusta, and coinciding, theoretically, with the contact between the old hard crystalline rocks that underlie the Central Upland and the younger, softer sedimentary sands and clays of the Coastal Plain. Because many streams flowing across this line cut through the covering of sands into the underlying crystalline rocks, this contact is irregular and minutely jagged. The hills and ridges separating the water courses are capped by sediments of the Coastal Plain but the old crystalline rocks are visible along the stream channels. It is impracticable, therefore, to fix a sharp line as the boundary between the Fall Line Hills and the Central Upland. The line chosen must be generalized and in a measure arbitrary.

The southern boundary of the Fall Line Hills is even more crooked than the northern. Starting from Chattahoochee River near the mouth of Cohelee Creek, west of Blakely, about 80 miles south of Columbus, the line follows the divide between the Chattahoochee and the Flint to Richland, passes north of Americus and crosses Flint River west of Vienna, thence northward, circling around the Fort Valley Plateau to Ocmulgee River below Echeconnee Creek. From Ocmulgee River it passes northward to Dry Branch, turns southwestward down Big Sandy Creek to Oconee River, thence northward along the western rim of the divide between Ohoopee River and Oconee River, circles the head waters of Williamson Swamp Creek, thence eastward and down Spirit Creek to Savannah River, about 15 miles south of Augusta.

Part of the Columbus sheet

THE FALL LINE HILLS NEAR CUSSETA

Scale $\frac{1}{62500}$

1 ½ 0 1 2 Miles

Contour interval 20 feet

Datum is mean sea level

The Fall Line Hills include several types of hilly country. The part nearest to the Central Upland is a region of long, gentle slopes and rolling hills. Farther south, the region is a level to rolling plateau cut by deep, steep-sided valleys and gullies. The dark red soils of the southern part of the Fall Line Hills contrast strongly with the lighter tones of the soils farther north.

Columbus, Augusta, and Macon are the principal cities of the Fall Line Hills. Ft. Gaines, Georgetown, Lumpkin, Cusseta, Buena Vista, Preston, Ellaville, Oglethorpe, Montezuma, Butler, Irwinton, and Thomson are county seats or otherwise noteworthy towns.

The hilliest part of the Fall Line Hills lies within the drainage basin of Chattahoochee River, particularly in Stewart County. The divide between the waters of the Flint and the Chattahoochee lies so near the latter that the short, swift tributaries of the Chattahoochee have intrenched their intricate drainage pattern 400 to 500 feet below the divide, which stands at a maximum altitude of about 700 feet above sea level. Many of these little streams head in steep-walled gullies or "caves" which range in width from a few feet to a quarter mile. Some of them are more than 100 feet deep. These intricate ravines lend picturesqueness to the landscape, but greatly interfere with cultivation of the soil and with travel. (See Plate XII-C). Growth o this type of ravines takes place rapidly. Removal of the protective covering of forest and brush exposes the soft, unconsolidated sands and clays to the erosive action of rain. Coalescing rills of rainwater gouge out an incipient gully in the hillside. The dislodged sand spreads out below in a fan-shaped mound while cutting continues at the heads of the rillways. The loose sand is undermined, falls, and is carried away by the water, and little ampitheatres with nearly vertical walls are formed. These gradually eat back farther and farther into the hillside until they encroach upon the upland plateau itself. The coalescing of adjacent ampitheatres gives rise to knife-edged ridges and pinnacles like those in the "Badlands" of the West.

The owest altitudes in this western part of the Fall Line Hills are found along Chattahoochee River, which drops from about 185 feet above sea level at Columbus to about 76 feet at the mouth of Cohelee Creek. The highest part is probably near Brooklyn, Stewart County, the altitude of which, according to railroad levels, is 691 feet above sea level. On the Columbus quadrangle, the only part of this area yet covered by a topographic map, the highest point, a hill east of Cusseta, is somewhat less than 600 feet above sea level (see Plate XV). The topography is characterized by long, narrow ridges with level or gently rounded summits, separated by deep V-shaped valleys. A peculiarity of the valleys of the larger streams, such as Upatoi Creek, Ochillee Creek and Oswichee Creek, is that they are narrow at the mouth but widen up-stream into broad, gentle slopes. Most of the tributaries of Chattahoochee River enter it through gorges. This is because the land was once considerably lower than it is now. The Chattahoochee and its tributaries then had broad valleys. As the land rose a fall or rapid developed at the mouth of the river and gradually ate its way

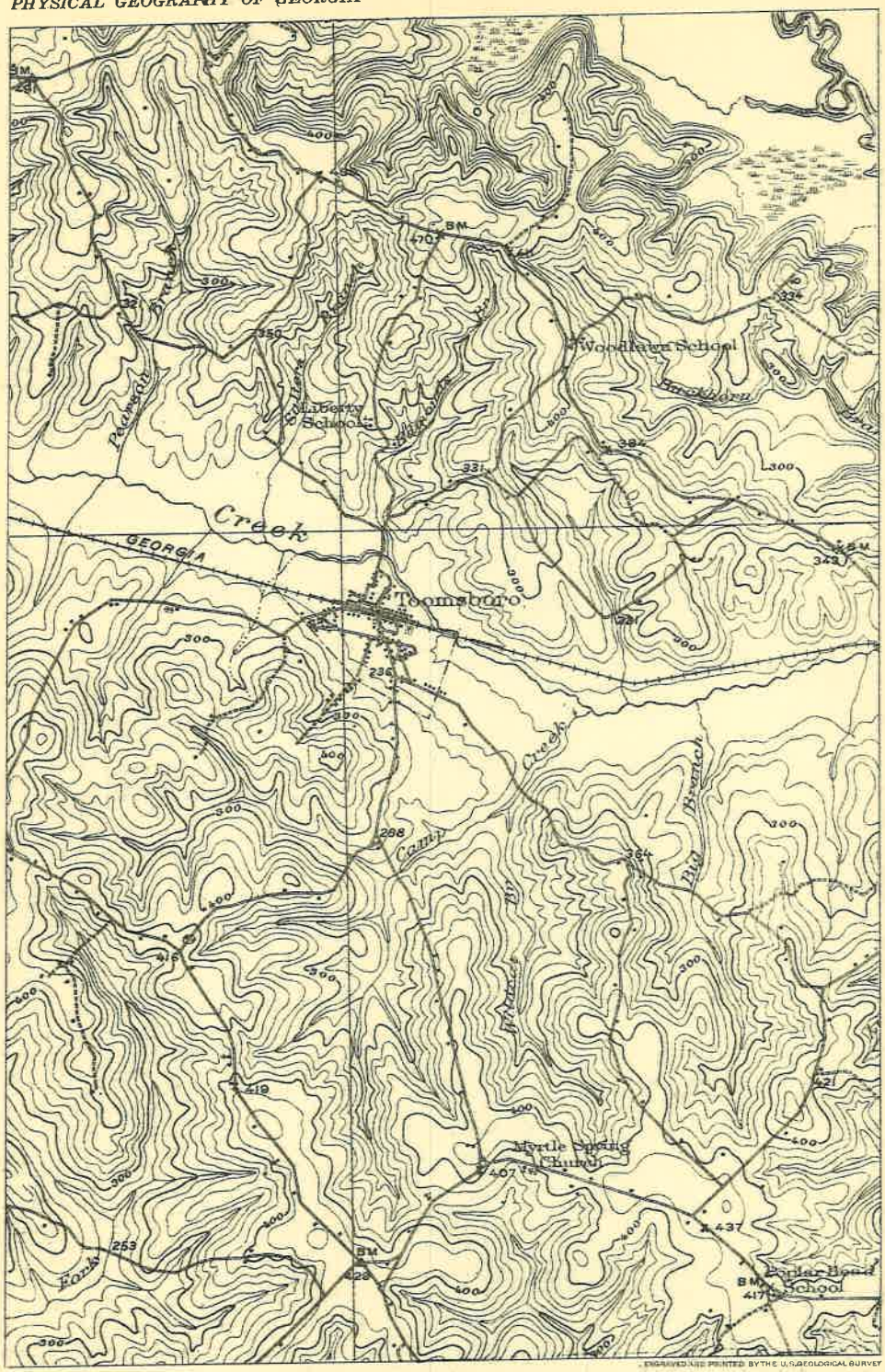
up-stream as far as Columbus where it is still gnawing at the hard rocks of the Piedmont. Each tributary stream below the rapid, quickened by its increased fall to the river, intrenched its lower reaches within its valley floor, but the more distant part of the stream is still flowing at its former level.

Between the Chattahoochee slope and Flint River, the Fall Line Hills are not so steep as near Chattahoochee River. Long, gentle slopes and broad, flat-bottomed valleys are the rule. Many of the areas between the streams are nearly level plateaus. Between Ellaville and LaCrosse, for instance the land is rolling to level, the soil is red sand, and the country is dotted with peach orchards and pecan groves. In many respects this part of the area included in the Fall Line Hills closely resembles the Fort Valley Plateau.

Between Flint and Ocmulgee rivers the belt of Fall Line Hills is narrowed by the encroachment from the south of the Fort Valley Plateau, and is divided into two parts by the long gentle slopes leading to Echeconnee Creek. The highest point known in this area is Rich Hill, whose nearly level summit stands at an altitude of about 707 feet above sea level. Rich Hill is one of a group at the edge of the Central Upland between Knoxville and Echeconnee Creek. The heads of several small streams have excavated deep gullies in the sides of these hills, which expose a capping of brilliant red sand which contrasts vividly with the white limestone and white micaceous sands and clays exposed in the steep walls.

East of Ocmulgee River the hills are steeper than west of it. A multitude of little lateral creeks and branches have cut an originally nearly level plateau into numerous narrow, flat-topped ridges which fork and cross in a very complicated pattern. This type of topography is well shown on Plate XVI. It might be said of this country that there are no hills in it—nothing but valleys. Most of the remnants of the plateau in which these valleys are carved stand at altitudes between 400 and 500 feet above sea level. The major streams, that is Ocmulgee and Oconee Rivers, have cut down to about 170 feet. The maximum relief, therefore, is in the neighborhood of 330 feet, although most of the shorter streams have cut their V-shaped valleys only about 150 feet below the plateau level. Nearly all the roads in this area follow the ridges. The clearings and houses, also, are most numerous on the ridges, although the Town of Toomsboro, built in the wide flat valley of Commissioners Creek (see Plate XVI) forms an important exception. The site of this town was probably determined by the location of the Central of Georgia Railway, which follows the easy grade of Commissioners Creek.

East of the divide between Ogeechee and Oconee rivers, the Fall Line Hills have long gentle slopes with no very definite pattern. The summits are rounded. There are few sharp ridges. Scattering outliers of Eocene sands form little plateaus, but such flat-topped areas are less numerous than farther west.



Part of the Irwinton sheet

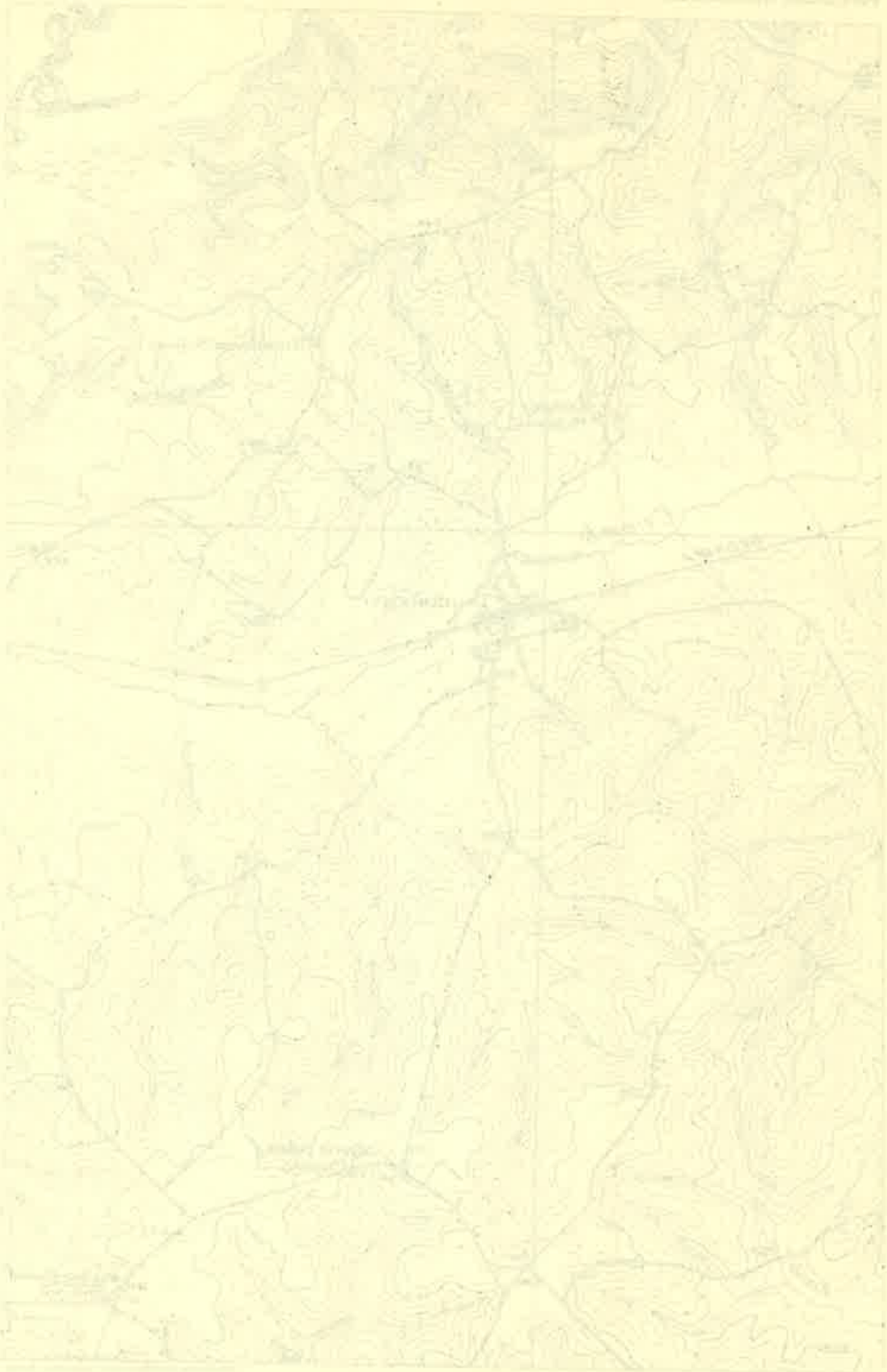
THE FALL LINE HILLS NEAR TOOMSBORO

Scale $\frac{1}{62500}$

1 ½ 0 1 2 Miles

Contour interval 20 feet

Datum is mean sea level



DRAINAGE OF THE COASTAL PLAIN

THROUGH-FLOWING AND INDIGENOUS RIVERS

The six principal rivers of the Coastal Plain of Georgia are what may be called through-flowing streams; that is, they rise outside the limits of the Coastal Plain and flow across it. These rivers, named from east to west, are the Savannah, the Ogeechee, the Oconee, the Ocmulgee, the Flint, and the Chattahoochee. The Chattahoochee and the Flint unite at the southwest corner of the State to form the Apalachicola, which flows across Florida into the Gulf of Mexico. The Ocmulgee and the Oconee together form the Altamaha, which empties into the Atlantic Ocean. The Ogeechee and the Savannah, likewise, enter the Atlantic. The through-flowing rivers differ from the smaller streams in the quality of their waters. At all times the water of the large rivers is more or less turbid, and usually it is stained red or reddish yellow by fine particles of mud derived from the red clay of the Central Upland.

The streams whose sources rise within the Coastal Plain are much cleaner than the through-flowing rivers. They are rarely muddy. Their sandy banks filter the water before it enters the streams. Although the water in these streams is clear, it frequently contains in suspension very finely divided particles of decayed vegetable matter which color it with shades of brown ranging from pale amber to almost black. This discoloration does not affect the wholesomeness of the water for drinking. Some of the Coastal Plain streams, such as Spring Creek in southwestern Georgia and Spring Mill Branch near Millen, derive most of their water from large springs. The water in these streams, at least near the source, is beautifully colorless, and limpid. Farther down stream they become more or less discolored by the swamps through which they pass.

DIRECTION OF FLOW

The general direction of flow of streams on the Coastal Plain is south-southeast. This direction, which is at right angles to the Fall Line and down the natural dip of the rocks, may be considered the normal course. In the eastern part of the State it is the shortest route to the sea, and for a much larger area it was the most direct route to the sea when the ocean extended farther inland than now and the coastal terraces were submerged.

Study of the map reveals many exceptions to this rule. Why does the Flint, below Albany, flow southwestward to Chattahoochee River? Why does the Ochlockonee flow southwestward? What is the explanation of the southwestward jog of the Withlacoochee? What causes the Ocmulgee to deviate from its normal course and flow northeastward before it joins the Oconee? Why does the Satilla run south and the St. Marys north before turning toward the sea? Why does the Suwannee, with its headwaters not far from the Atlantic, box the compass and at last find its way into the Gulf of Mexico? These are some of the anomalies that need to be explained.

An explanation of the anomalous courses of the Satilla and St. Mary s has already been suggested (see page 32.) After the emergence of the Penholoway terrace but while the Satilla terrace was still under water, barrier ridges were built up by the waves across the ancient mouths of these streams. When the Satilla terrace emerged, the rivers, finding their direct courses to the open sea effectually blocked by these ridges, turned southward and northward in the lagoon behind the ridges until they found a passageway through.

The history of the Satilla and St. Marys rivers offers a clue to a possible explanation of the anomalous directions of several other streams. Ocmulgee River, along Jeff Davis County, flows parallel to and not far from the supposed inner margin of the Hazlehurst terrace. The diversion of this river might very readily have been brought about in the same manner as but at an earlier date than the diversion of the Satilla River. The diversion of the Withlacoochee and of the Ochlockonee may be due to similar agencies.

The explanation of the erratic course of the Suwanee is a little more complex. When the Okefenokee terrace emerged, the water of Okefenokee Sound, cut off from the Atlantic by Trail Ridge, found an outlet at the southwest, and Suwanee River incised its channel there. As emergence proceeded, Suwanee River extended first across the Penholoway and later across the Satilla terrace, but was obliged to search out passages across several old barrier ridges that had been built up parallel to successive shore lines.

The course of Flint River is determined primarily by the physical properties of the geologic formations across which it flows. At the mouth of Lumpkins Creek in Dooly County Flint River enters a region underlain by limestone, which is soluble and therefore more rapidly worn away than the sandy beds adjoining the region on the southeast, and continues on the limestone to its mouth. Although it must have attained this course, the line of least resistance, only after a long series of repeated readjustments, the present order has been established for such a long time that evidences of the changes in drainage are probably obliterated.

RIVER SYSTEMS

Savannah system. The part of the drainage basin of Savannah River lying within the Coastal Plain of Georgia includes about 2,030 square miles. It gradually narrows from a maximum width of about 30 miles near Augusta to four or five at Savannah. Savannah River, a through-flowing stream, always muddy, is navigable by small boats to Augusta.

Brier Creek, rising near the edge of the Central Upland in Warren County, enters Savannah River east of Sylvania. It is a swift, deep stream with clear, brown water. At Bryans Bridge, below Hilltonia, it flows in many runways through a swamp half a mile wide. The main channel is about 100 feet wide. At Millhaven there is no swamp and only one channel.

Beaverdam Creek, the largest tributary of Brier Creek, is a pretty stream about 50 feet wide near its mouth. The water is very clear but slightly tinged with brown. Shallows alternate with deep pools.

Ogeechee system. The area of the Ogeechee Basin within the Coastal Plain is approximately 4,450 square miles. The Ogeechee is the shortest of the through-flowing rivers. It carries less mud from the Central Upland and is not so red as the other large rivers. At Midville it is about 175 feet wide. The banks are low, swampy, and closely overgrown by cypress. Below the mouth of Canoochee River the Ogeechee is 600 feet wide, the water is amber-colored, and subject to a 5-foot tide.

Rocky Comfort Creek, entering from the east, and Williamson Swamp Creek, entering from the west, are the principal tributaries of the upper part of Ogeechee River. Buckhead Creek, at Millen, is a deep, sluggish stream 75 feet wide, with clear water appearing dark-green in depths. The bottom is sandy. The banks are densely overhung by cypress.

The largest tributary of the Ogeechee is Canoochee River. At Claxton Bridge the Canoochee is about 100 feet wide. A rapid is caused by a ledge of sandstone in the bed.

Altamaha system. The Altamaha, draining 8,800 square miles within the Coastal Plain, is the largest river whose drainage basin lies wholly within Georgia. It is formed by the union of the Oconee and the Ocmulgee, which bring into it great quantities of red mud from the Central Upland. The volume of water carried by the Altamaha is somewhat less than that of the Savannah and perhaps a little greater than that of the Chattahoochee.

Ohoopee River is the largest tributary of the Altamaha below the junction of the Oconee and the Ocmulgee. It is a typical Coastal Plain stream, with amber-colored water and sandy bottom. At Cow Ford Bridge, 1½ miles above its mouth, it is about 150 feet wide at low water. It swings against a 60-foot bluff on the east side, but the west bank is low and swampy. A rapid at Shepards Bridge, west of Reidsville, is caused by a ledge of sandstone that forms the right bank. Near Adrian Ohoopee River flows in several channels through a swamp.

The Oconee and the Ogeechee are both large, muddy, navigable streams averaging within the Coastal Plain about 250 feet in width. They unite to form the Altamaha. The principal tributaries of the Oconee are Buffalo Creek, on the east, and Commissioners, Big Sandy, and Palmetto Creeks on the west. Tobesofkee and Echeconnee creeks, both rising in the Central Upland, enter Ocmulgee River from the west. Big Indian Creek and Tucsawhatchee Creek also enter from the west.

Satilla system. All the tributaries of Satilla River rise within the Tifton Upland or the coastal terraces. They are rather sluggish streams with sandy banks and bottoms, amber or coffee-colored water, and flow through swamps.

Near Waycross, Satilla River is about 150 feet between banks (see Plate VI-C). Little Satilla River, Alabaha River (Hurricane

Creek), and Seventeenmile Creek are the principal tributaries. The area drained by Satilla River and its branches is approximately 3,500 square miles.

St. Marys system. St. Marys River drains an L-shaped area containing about 725 square miles in the southeastern corner of Georgia. It rises in Okefenokee Swamp, flows southward, turns east through a gap in Trail Ridge, then north, and finally east again to the Atlantic at Cumberland Sound. It forms the boundary between Georgia and Florida. Its water, like that of most Coastal Plain streams, is stained coffee-colored by vegetation. No large tributaries enter St. Marys River.

Suwanee system. The Suwanee Basin in Georgia contains about 5,520 square miles in the southern part of the State, and includes most of Okefenokee Swamp. Only the headwaters of Suwanee River, short streams flowing southeastward into Okefenokee Swamp, lie wholly within the State of Georgia. Alapaha River and Withlacoochee River, much larger streams, enter the Suwanee beyond the State line.

Alapaha River near Milltown is a rapid, shallow stream about 100 feet wide. It rises in Wilcox County.

Withlacoochee River, also, is a swift stream with occasional rapids. Its principal tributaries are Little River, Allapahoochee Creek, and Okapilco Creek. Okapilco Creek, near Quitman, flows in a valley that seems disproportionately large for such a sluggish stream. In the southeastern corner of Colquitt County only a low, narrow divide separates Okapilco Creek from the more rapid waters of Little River. It is not improbable that the headwaters of Little River once flowed across this sag and down the lower course of Okapilco Creek until a more active tributary of the Withlacoochee, pushing its head northwestward, tapped the bank of Little River and diverted its waters into their present course. Stream piracy of this type is not unusual, but is difficult to detect without topographic maps.

Ochlockonee system. Ochlockonee River, which flows through Florida into the Gulf of Mexico, drains an area in Georgia of about 1,145 square miles chiefly in Grady, Thomas, and Colquitt Counties. Like most of the streams in the Coastal Plain, the banks and bottom of Ochlockonee River are sandy, but the water is not so deeply tinged with brown as the rivers farther east. The country through which it flows is more hilly and contains fewer swamps. On the Tallahassee Road 7 miles southeast of Cairo, the river is deep and about 100 feet wide. (See Plate VI-D). It is bordered on the west by a flood plain one-half mile wide and 6 feet above water. The east bank slopes steeply up to a broad, level terrace 40 or 50 feet above the river.

Flint system. Flint River, one of the through-flowing streams, drains an area of 6,000 square miles within the Coastal Plain. It is navigable by small steamboats to Albany. Its water is always muddy, but is somewhat diluted in its lower reaches by the influx of clear water from several large tributaries. The river receives its name from blocks

of flint or silicified limestone, which block the channel at many places and cause shoals and rapids.

Flint River is bordered by fewer and smaller areas of swamp than the rivers of the eastern part of the Coastal Plain. The longest swamp lies between Faceville and the mouth of the river. Throughout the greater part of its course, the river has cut its channel at least 15 feet below its floodplain.

Muckalee Creek and Kinchafoonee Creek, rising near the western edge of the Dougherty Plain, unite to form the Muckafoonee, which enters Flint River above Albany. Coolewahee Creek, flows southward through a shallow, swampy valley to Flint River at Newton. Ichawaynochaway Creek and its tributary Chickasawhatchee have shallow swampy valleys. Spring Creek at Brinson is a clear, cool stream flowing over a rocky bottom. It is fed by many large springs. It enters the Flint about 3 miles above the junction with the Chattahoochee.

No large streams enter the Flint from the east. The river in few places lies more than 15 miles west of the divide separating it from other drainage basins. In the latitude of Fort Valley the head of Big Indian Creek, a tributary of Ocmulgee River, lies less than three miles from the Flint.

Chattahoochee system. Although it is a much longer and larger stream than the Flint, Chattahoochee River drains only 1,800 square miles within the Coastal Plain, less than one-third as much as the Flint. The Chattahoochee receives a much larger proportion of its water from outside the Coastal Plain, and consequently is muddier and more highly discolored than the Flint. Like the Flint, the Chattahoochee has intrenched its channel in its flood plain. Except for the lower 17 miles, Chattahoochee River has little swamp. Outcrops of rock are many.

There are no large tributaries of Chattahoochee River within the Coastal Plain of Georgia above the mouth of the Flint. Upatoi Creek, Hannahatchee Creek, and Pataula Creek are the most important. Nearly all the tributaries enter Chattahoochee River through deep, narrow gorges, but upstream the valleys widen. The grades of these streams are not adjusted to a permanent base level, but are steeper near their mouths than in their intermediate courses. This fact indicates that the master stream, Chattahoochee River, has within recent times cut its channel below its ancient grade and that the tributary streams are now in the process of adjustment to the new base level.

Smaller systems. An area of about 800 square miles lying between the Ogeechee basin and the Altamaha basin is drained chiefly by North and South Newport rivers and by Sapelo River. These are short streams, subject to tide throughout their lower courses, which flow into the estuaries back of the sea islands. Similar areas of 340 and 100 square miles, between the mouths of Altamaha, Satilla, and St. Marys rivers are drained by Turtle River, Little Satilla River, and Crooked River.

The headwaters of Aucilla River drain a triangular area of 280 square miles adjacent to the Florida line in Thomas, Brooks, and Grady counties

PONDS, LAKES, AND SINKS

The lakes and ponds of the Coastal Plain of Georgia may be divided into three groups depending upon the origin of the containing basin, whether it be (1) an abandoned river channel, (2) an original depression, or (3) a solution hollow.

Old cut-offs and other abandoned river channels on the flood plains and in the swamps of the larger streams are filled with water during floods and the dirty water trapped in them usually remains until the succeeding freshet. Lakes of this kind are common along Savannah River and some are found along all the large streams.

The old sea floor exposed by the withdrawal of the water from the several coastal terraces has been so little modified by erosion that many of its original inequalities still persist. Rainwater accumulates in shallow depressions with no outlet and converts them into ponds or lakes. Some are so small that they dry up during summer; others retain water throughout the year and are permanent lakes. Most of them are more or less swampy, and many are thickly overgrown by cypress. Okefenokee Swamp occupies the largest natural depression of this kind in Georgia, and the lakes in it are remnants of a much larger body of water. Banks Lake, near Milltown, Lanier County, although its level has been raised by damming one of its outlets, probably is of this type.

Depressions or sinks formed by the solution of beds of limestone underground and the settling of the overlying materials are common in many parts of the Coastal Plain. The Dougherty Plain is dotted with them (see Plate XII-A); there are a good many along the western edge and some in the interior of the Tifton Upland; the Louisville Plateau is not free from them; and both large and small sinks are found in the coastal terraces. All gradations of sinks occur from pits with vertical walls to shallow saucer-shaped depressions with gently sloping sides. Many sinks contain water in wet weather and some are perennial ponds. The water level in nearly all varies with the seasons; in many it coincides with the ground-water level of the surrounding region. Some of these sinks are connected by open passages with underground channels which carry away water as fast as it enters but the majority have sandy or muddy bottoms through which the water percolates more slowly.

The largest lakes occupying solution hollows are in the southern part of Lowndes County. The town of Lake Park is in the midst of them. They are beautiful expanses of clear water fringed with moss-hung trees. Ocean Pond, at the southwestern edge of Lake Park is the largest. Its area as mapped by the U. S. Bureau of Soils is a trifle greater than one square mile. Long Pond, less than half a mile north of Ocean Pond, and half as large, appears to have been formed by the coalescing of three or more smaller ponds. Its gently sloping sandy banks afford no exposures of rock. The bottom is gently shelving. The beach at some places is clean sand, but elsewhere it is covered with a scanty growth of water grasses. The water level in August, 1923, was 15 feet below the road at Concord School, but is said to fluctuate with the seasons. Sinks are so numerous in southern Lowndes,

Brooks, Thomas, Grady, and Decatur counties that some writers regard this region as an independent topographic division and designate it "Southern lime-sink region." [1]

SWAMPS

It is estimated that eight million acres, 12,500 square miles, of land in Georgia lack good drainage. Of this enormous area, all but 700,000 acres lie within the Coastal Plain. Three million, eight hundred thousand acres are swamp or subject to periodical overflow. Tidal marsh accounts for about 352,000 acres. [2]

Leaving out of account the tidal marshes, which are discussed on page 22, swamps may be divided into two classes, river swamp and upland swamp. River swamps are simply flood plains that lie so little above the normal water level of the streams that they are flooded by even a slight freshet. Upland swamps are not flood plains in the usual meaning of the term, and are generally not associated with well defined water courses. They are situated in interstream areas. By the use of the word upland it is not intended to imply that the swamp so called lies at a considerable altitude, for many swamps classified as upland are less than ten feet above sea level.

Nearly every stream in the Coastal Plain of Georgia, particularly in the area east of the Flint River basin, is bordered by strips of swamp. Along some streams the swamps extend to the very head and may merge there with swamps of the upland type. Other streams that head in better drained country enter swamps in their lower courses. The river swamps range in width from a narrow fringe to several miles. The swamp along the Savannah at the mouth of Brier Creek is 4½ miles wide; the Ogeechee swamp opposite Egypt is 3 miles wide; the swamp above the head of tide on Altamaha River is more than 6 miles wide. The width of river swamps depends, in large measure, upon the topography of the adjacent area.

Most river swamps are overflowed only occasionally. The greater part of the time they are above water level. Peat can accumulate in them only in exceptionally low places. The soil in them, therefore, is chiefly sand and mud mingled with leaves and pieces of wood. These swamps are crossed by a labyrinth of runways which carry off the flood waters. Abandoned channels, frequently full of water, are common. The river swamps, as a rule, are forested with a considerable variety of trees. Besides bald cypress, black gum, and other water-loving trees, the higher parts of the swamps contain many species that are not injured by occasional floods but will not tolerate constant submergence. Underbrush, except in the cut-over places, is generally thinner than in the upland swamps.

The water level in upland swamps fluctuates less than in river swamps. It is affected little, if at all, by distant rains. The effect

1. Veatch, Otto, Geology of the Coastal Plain of Georgia: Georgia Geol. Survey Bull. 26, pp. 34-35, 1911.
2. Brantley, J. E., and Phillips, J. V., Wet and overflowed land in Georgia: Georgia Geol. Survey Bull. 32, p. 108, 1917.

of droughts is shown chiefly around the edges, where a slight lowering of the level may expose a large area to the air. Many aquatic plants which do not thrive in the river swamps find a congenial habitat in the more uniform upland swamps, but trees and shrubs that need to be dry during the growing season are drowned out.

Upland swamps develop wherever the rainfall is in excess of the loss of water by run-off, by evaporation, and by the expiration of plants. The prime factor affecting the rate of run-off is the slope of the surface but even on steep slopes the run-off may be greatly retarded by a tangled mass of vegetation. Evaporation, also is diminished by a cover of vegetation. If sufficient water is retained to prevent the complete decay of the vegetable waste which falls to the ground, peat is formed and may accumulate to a considerable depth.

The flatness of the coastal terraces of Georgia, the humidity of the atmosphere, the even distribution of the rainfall throughout the year, and the mild climate, are conditions especially favorable for the formation and persistence of swamps. Large areas on all the coastal terraces are swamp.

Okefenokee Swamp. The largest and most notable upland swamp in Georgia is the Okefenokee. It extends from a point about 5 miles south of Waycross southward a distance of about 39 miles to an ill-defined termination a few miles beyond the State line. Its eastern edge, part of which is shown in plate IX is sharply marked by Trail Ridge, and is nearly straight; its western edge is made very crooked by projections that extend from the main area of the swamp up the valleys of all the tributary streams. The area of the swamp is computed to be about 660 square miles. Okefenokee Swamp occupies part of the divide between the Atlantic Ocean and the Gulf of Mexico. Part of it drains southward into the headwaters of St. Marys River, but the greater part of its water passes westward into Suwanee River. Much of the swamp is forested, but there are within it patches of grassy prairie similar to the Everglades of Florida many square miles in extent, the monotony of which is relieved by occasional clumps of bushes and trees. Although there are many small lakes within Okefenokee Swamp, none are comparable in size to Lake Drummond in Dismal Swamp or to Lake Okeechobee in the Everglades.

The surface of Okefenokee Swamp slopes very gently toward the southwest. The northeastern part lies a little higher than 120 feet above sea level; the southwestern part a few feet lower.

Okefenokee Swamp contains many islands which do not differ much from the surrounding mainland. They are so flat that rainwater drains away very slowly. The ground is carpeted with saw palmetto, heath plants such as huckleberries, blueberries, and gall berries, sedges, and other small herbs. The sandy interior parts of the islands are forested with long-leaf and slash pine but the more fertile margins of hammock land support a luxuriant growth of live oak, water oak, magnolia, bay, and sweet gum. Plate XVII-C shows a pine forest on Billys Island. Black Jack Island, Bugaboo Island, and Cowhouse Island are worthy of mention.

Photographs by S. W. McCallie.

OKEFENOKEE SWAMP

A. PRAIRIE. B. LAKE AND CYPRESS BAY. C. BILLYS ISLAND.

Many of the islands adjoin cypress "bays" in which the swamp muck is too deep for pines to grow. Pond cypress, black gum, and several kinds of bay trees, all heavily festooned with Spanish moss, are the principal trees of the bays. The undergrowth of shrubs is tied into an impenetrable jungle by smilax, muscadine grapes, and other vines.

Some of the islands are surrounded by sphagnous bogs in which the muck and water is covered by 4 to 6 feet of sphagnum moss, thick and dense enough to walk upon but quivering under foot in a manner to suggest the name Okefenokee, which means "trembling earth." Great numbers of large pitcher plants carpet the boggy places.

Much of the eastern part of Okefenokee Swamp consists of great everglades called "prairies" (see Plate XVII-A). These everglades are not prairies in the usual meaning of the term, for they are partly covered by water. The water over most of them is shallow enough to permit a rank growth of grasses and water lilies, but in some places is deep enough to form open lakes. Grand Prairie, which contains more than 50 square miles, is probably the largest. Within it are Gannett Lake, Buzzards Roost Lake, Coward Lake, Seagrove Lake, and several smaller bodies of water. Chase Prairie, Territory Prairie, and Durdin Prairie, which connect with Carters Prairie, lie farther north. Okefenokee Canal passes through several of these prairies and cuts across Trail Ridge at Camp Cornelia. Within the prairies are many small islands or cypress "heads" covered with cypress trees and evergreen vines and bushes (see Plate XVII-A and B.)

The water in Okefenokee Swamp is not stagnant but most of it is perceptibly in motion. The current is strongest in the runways which cut through the cypress bays and form a very crooked system of watercourses which finally unite to form Suwanee River.

The fastnesses of Okefenokee Swamp form a retreat for many kinds of wild animals which have been almost exterminated on the mainland. Alligators and turtles find a congenial home in the bays and ponds; ducks and other water fowl frequent the prairies; great owls doze in the shady cypresses while wild turkeys and quail seek their livelihood on the islands.

As has been explained on page 31 of this volume, Okefenokee Swamp occupies what was once the deeper part of "Okefenokee Sound," a body of salt water partly shut off from the open ocean by a sand spit and barrier reef now called Trail Ridge (see Plate X-B). When the shoreline retreated to the inner limit of the Penholoway terrace the sound was reduced to a shallow lake with islands and with an overflow outlet through Suwanee River. During the long time that has elapsed since this lake came into existence the gradual accumulation of vegetable waste has nearly filled the basin with peat. The sandy bottom of the remaining patches of open water and the sandy soil of the islands probably are remnants of the original bottom of the sound, little changed from its original condition. In its earlier stages, Okefenokee Swamp may have resembled Dismal Swamp or the Everglades, both of which are much younger than the Okefenokee.

More detailed accounts of Okefenokee Swamp are contained in the following publications:

Loughridge, R. H., Report on the cotton production of the State of Georgia, with a description of the general agricultural features of the State: Tenth Census of the U. S., vol. 6, pt. 2, p. 317, 1884.

Nesbitt, R. T., Georgia: Her resources and possibilities, pp. 244-248, Atlanta, 1895.

Carr, M. E., and Tharpe, W. E., Soil survey of the Waycross area: Field operations of the Bureau of Soils, 1906, p. 330, 1908.

Harper, R. M., Okefinokee Swamp: Popular Science Monthly, vol. 74, pp. 596-614, 1909.

Veatch, Otto, Physiography, in Veatch and Stepheson, Geology of the Coastal Plain of Georgia: Georgia Geol. Survey Bull. 26, pp. 44-49, 1911.

McCallie, S. W. Drainage Reclamation in Georgia: Georgia Geol. Survey Bull. 25, pp. 14-19, 1911.

Wright, A. H., and Harper, Francis, A biological reconnaissance of Okefinokee Swamp: The Auk, vol. 30, pp. 477-505, Oct., 1913.

THE PROVINCES OF APPALACHIAN GEORGIA

By Laurence LaForge

LOCATION AND DISTINCTIVE CHARACTERS

Northern or Appalachian Georgia, including about 40 per cent of the area of the State, is a part of the Appalachian region, which comprises much of the eastern portion of the United States and all of Canada south of St. Lawrence River. In Georgia, as throughout the Atlantic seaboard south of New York, the Appalachian region is bordered on the southeast by the Coastal Plain, already described. On the northeast, north, and west the boundaries of the Appalachian region lie far outside the limits of the State.

Appalachian Georgia differs from the Coastal Plain in several ways. It is an upland area, whose upland surface is nearly everywhere more than 500 feet above sea level and rises to about 2,000 feet at the north. Most of the valleys that trench the upland are several hundred feet deep, and here and there eminences rise several hundred feet above the general surface of the area, which thus has considerable relief. The northeastern and northwestern parts are mountainous and in the northwestern part the mountains are mainly long, narrow ridges that have the same general trend. In all these respects Appalachian Georgia differs notably from the Coastal Plain.

The rocks of Appalachian Georgia are indurated and those of the greater part of the area are also crystalline. Everywhere they have been much deformed, so that the structure of this part of the State is of the sort known as disordered. On most level or gently sloping areas the rocks are disintegrated to a depth of many feet and the surface is largely formed of residual material. Outcrops of solid rock are, in general, confined to summits, steep slopes, stream channels, etc. In all these respects, also, Appalachian Georgia differs from the Coastal Plain.

DIVISIONS AND BOUNDARIES

Appalachian Georgia can be divided into two quite unequal portions. In the larger one, sometimes called the "crystalline area," from the character of its rocks, the topography, in its broader aspects, seems to lack system, and, with only minor exceptions, the relief features and the courses of the streams, except Chattahoochee River, show little indication of conforming to a prevailing structural trend. This part, also, has rather strong relief, especially in the northeast, developed on crystalline rocks of highly disordered structure.

The smaller portion, sometimes called the "Paleozoic area," from the geologic age of its rocks, lies northwest of the other, from which it differs in several respects. Its topography is not so diverse and is more systematic. Most of the larger features of the relief are linear, with a well-defined trend, which is shared by the courses of the main

streams except in the broadest valleys. The structure, although much disordered, is less so than in the "crystalline area," and the valleys, especially the wider ones, owe their existence and trend to the structure instead of being merely stream trenches. The rocks are not crystalline, except in part at the eastern side of the area.

The boundary between the "crystalline area" and the "Paleozoic area" is nearly everywhere well marked by a bold westward-facing or northwestward-facing escarpment, 300 to 700 feet high. This crosses the Georgia-Tennessee boundary at a point 2 miles east of Tennga, on the L. & N. Railroad, and extends southward just east of Chatsworth, Fairmount and Cartersville to Etowah River. Thence it continues southwestward and westward, a little west of Braswell and a little south of Rockmart and Youngs, and crosses the Georgia-Alabama boundary at a point a mile south of Esom Hill station on the Southern Railway. On the whole this boundary is better defined than that between Appalachian Georgia and the Coastal Plain.

Each of these two parts of Appalachian Georgia includes two divisions of very unequal size. These four divisions: the Highland, the Central Upland, the Valley and the Lookout Plateau, are the four physiographic provinces of Appalachian Georgia. Each is part of a province of the Appalachian region and includes all of that province within the State. Thus the Highland is part of the Appalachian Mountains, the Central Upland is part of the Piedmont Upland, the Valley is part of the Appalachian Valley and Ranges, and the Lookout Plateau of the Appalachian Plateaus.

The Highland and the Central Upland on one side and the Valley on the other side are separated by the escarpment just described. The boundary between the Valley and the Lookout Plateau is defined by the eastern slope of Lookout Mountain. The Highland and the Central Upland, however, are not separated by a definite boundary, but by a zone in which spurs of the mountains and fingers of the Upland are so mingled that any boundary that can be drawn must be very crooked and so much generalized that its delineation is largely a matter of personal judgment.

THE CENTRAL UPLAND

GENERAL RELATIONS

The greater part of Appalachian Georgia is a broad upland which crosses the middle of the State between the Highland and the Valley on the north and the Coastal Plain on the south. It has an area of about 18,100 square miles and comprises approximately 78 per cent of Appalachian Georgia or 31 per cent of the whole State.

This Central Upland is part of the Piedmont Upland province of the Appalachian region. In Georgia it occupies ten times as much area as the mountainous Highland, so that most of it cannot be literally "at the foot of the mountains," and the name Piedmont is therefore in a measure misleading. Hence the name Central Upland has has been given to the part of the province within the State, to express its relation to the other divisions.

In its general character the Central Upland is essentially an upland area of fairly strong relief, developed through repeated and long continued wearing away of a region of disordered crystalline rocks which nearly everywhere have been deeply weathered and disintegrated. The rocks have not been much deformed since remote geologic times and the movements of the earth's crust in this area during and since the development of the general upland surface have been of the gentler sorts. Nevertheless they were so numerous and so varied in their effects on the genesis of the present surface relief that the Upland is by no means so uniform in character as is often commonly assumed after a hasty general view of it.

A knowledge of the Central Upland derived only from what can be seen on a few journeys across it on different routes would seem to justify the conclusions that, except in two or three relatively small districts, its topographic character is much the same throughout, and that no well marked subdivisions can be recognized. Detailed study of the field, however, supplemented, as is necessary in such a region, by equally detailed study of the topographic maps, shows that a number of different types of topography can be distinguished. In making such distinctions it is necessary to consider, not only the general form of the surface and the larger features of the relief, but all the elements of the topography as outlined in a previous chapter, including the drainage pattern, which, in many districts, is one of the most important elements.

SUBDIVISIONS AND BOUNDARIES

The Central Upland is bounded on the northwest by the Valley, on the north by the Highland, and on the south by the Coastal Plain, and extends northeastward into South Carolina and westward into Alabama. The boundary between it and the Valley is nearly every-

where well defined by an abrupt escarpment, 300 to 700 feet high facing the Valley. Although there is a marked difference in the general topography of the Upland and of the Highland, the boundary between them is not well defined. This is because the two types of topography are intermingled in a belt several miles wide in which spurs of low mountains extend from the Highland into the Upland and lobes of plateau from the Upland penetrate the Highland. The upland surface and the foothill slopes merge so that any boundary must be, in a measure, arbitrary in many places.

On the southern side of the Upland the boundary between it and the Coastal Plain is also difficult to delineate, but for a different reason—lack of sufficient topographic distinction. In only a few places in Georgia, are the two provinces separated by an escarpment or other marked topographic line. As a rule the generally flat surface on the main divides extends from one province into the other without a break and the main valleys are of about the same depth in each.

The Central Upland may first be considered as comprising two sections here named Midland Georgia and Piedmont Georgia. (See fig. 3.) The line between them crosses Tugaloo River just below the gorge through Chattooga Ridge and follows rather closely, as far as Newnan, the divide between Chattahoochee River and the streams flowing southeastward. Beyond Newnan it is rather indefinite, but it continues on a southwesterly course, crossing the Chattahoochee near Franklin and passing into Alabama near Texas in Heard County. These two sections correspond roughly to the two regions long recognized in central Virginia and there called Piedmont Virginia and Midland Virginia. The southeastern section includes the indefinite area locally called Middle Georgia, and the name Midland is appropriate for other reasons also. The northwestern section is called Piedmont Georgia, although perhaps less appropriately as very little of it is a true Piedmont area, nevertheless it is analogous in several important respects to the Virginia Piedmont.

The most striking difference between the two sections is in their drainage patterns, which are quite unlike, and they are more easily distinguished on a drainage map of the State than on a contour map. The streams of Midland Georgia flow southeastward to the Atlantic and southward directly to the Gulf, those of Piedmont Georgia flow southwestward and westward to reach the Gulf. The drainage pattern of Midland Georgia is dendritic, that is, each river system resembles a branching tree. The main streams flow across the trend of the rock structure in the direction of the general slope of the upland, and branches flowing directly along the trend of the structure are rare. The drainage pattern of Piedmont Georgia has no definite system or relation to other elements of the topography. The main streams, however, are for much of their length of the sort called **longitudinal,** that is, they flow along the trend of the rock structure, and there appear to be vestiges of a former **trellised** drainage pattern, one resembling the arrangement of the stems of a grapevine on a trellis. Another striking feature of the drainage patterns is

that, on a drainage map of the State, Midland Georgia is not distinguishable from the Coastal Plain, as both areas have the same sort of dendritic drainage pattern. Similarly Piedmont Georgia has the same sort of drainage pattern as the Coosa Valley portion of the Valley, from which it is not distinguishable on a drainage map. The Highland, also, is barely distinguishable from Piedmont Georgia on such a map.

Although the difference in their types of drainage patterns is the most striking distinction between the two sections, they are also distinct in other ways. Piedmont Georgia has considerable diversity of relief. Its general upland surface, which slopes in different directions in different parts, is broken by scattered residual hills and small mountains, technically called **monadnocks,** which stand 100 to 1,000 feet above the general surface. In some areas these form small mountain groups. Excluding the numerous monadnocks the general upland surface is not very smooth, and some parts of it are so completely and deeply dissected that its upland character is disguised and it appears to be an irregularly hilly tract It is drained in several directions—southeastward to Savannah River, southwestward by the Chattahoochee, westward by the Tallapoosa, and northwestward to Coosa River. Variety, therefore, characterizes the topography of most of Piedmont Georgia.

Midland Georgia differs from Piedmont Georgia in all the respects recounted above. Except in some rather small areas it has little diversity of relief and the strikingly smooth surface of the upland slopes generally southeastward. Outside of one district, monadnocks are few and small and in large parts of the section there are none. The main river valleys, though deep, are narrow, and the upland character of the region is still distinguishable close to them. The drainage is all in one general direction and most of it flows directly to the Atlantic. Uniformity, therefore, characterizes the topography of most of Midland Georgia.

Each section includes several districts with different types of topography, (Figure 3). These districts so merge that in many places no definite boundaries can be drawn between them, even though the types of topography are fairly distinct outside the zones of merging. The boundaries as now drawn are to be regarded as merely approximate except in a few places. The districts that they separate are of minor rank and seem hardly worth recognition. Their use is justifiable, however, for convenience in description, if for no other reason, but they are by no means without scientific value as well.

Another help in the delineation of the districts is the fact that the Central Upland is not a single upland, but is made up of several that lie at different altitudes and are to some extent of different origin. Piedmont Georgia comprises three fairly distinct parts, each of which can be subdivided into several. Those of higher rank are fairly distinct and deserve recognition and naming. They are: the Dahlonega Plateau, in the northern part of the section; the Atlanta Plateau, across the middle part; and the Tallapoosa Upland, in the western

part. Midland Georgia also comprises three topographic districts. They are: the Washington Plateau, in the southeastern part of the section; the Midland Slope, in the northern and central parts; and the Greenville Plateau,in the southwestern part. The Greenville Plateau, moreover, includes a district—the Pine Mountain district—which is so distinct as almost to warrant giving it rank as a fourth subsection. It is sufficiently important so that it is named and described separately. The positions and boundaries of the several districts are shown on the index map of the Central Upland, fig. 3.

TOPOGRAPHIC CHARACTER

Some idea of the topographic character of the Central Upland is conveyed in the preceding paragraphs, but the statements are mainly general and in abstract rather than concrete form. A more concrete outline description is given below.

The Central Upland is, as its name indicates, an upland area. It includes some deep valleys, but no lowlands and some mountains and small mountain groups, but no highlands, such as mountainous areas or high plateaus. Its general altitude above sea level is a little less than 2,000 feet along the southern base of the Highland, and 1,100 to 1,500 feet along its northwestern margin, next to the Valley. Along its southern margin, adjoining the Coastal Plain, its altitude is 500 to 700 feet above sea level. The surface, as a whole, descends southeastward from one side of the Upland to the other, but the slope is not uniform nor is it everywhere in the same general direction. Several plateaus and upland areas, lying at different altitudes, are separated from one another, in some places by sloping escarpments, in other places by slopes too broad and gentle to be called escarpments, and in still other places by slopes so gentle that they are not seen as slopes in the field, but are brought out by contour maps. The surface of some of the plateaus is made up of two or more platforms, lying at somewhat different levels, and separated by sloping escarpments.

The general surface form is also diverse. In some areas residual hills and mountains, standing above the general surface, are so numerous that the true nature of the district is obscured and it appears almost mountainous. In others, the uniform sky line of a nearly smooth upland surface is broken, if at all, only by a few scattered knobs. Again, in some places especially along main divides, the surface of considerable areas is nearly level and is unbroken by sharp ravines or deep valleys. In other places the valleys are deep and the dissection is so complete that little of the upland surface is left and the district appears to be a maze of sharp-topped hills and narrow, winding ridges.

A belt of hilly country scarcely recognizable as part of the Upland, so many and large are the residual mountains that stand above the general level, and so deep and sharp are the valleys that are cut below it, forms the northern portion of the Upland, along the southern base of the Highland. This is the district named the Dahlonega

Plateau (See fig. 3.), the only truly "piedmont" country in Georgia. The general altitude of its surface is 1,800 feet or more close to the base of the Highland and about 1,400 feet near the southern margin of the district.

Southwest of the Dahlonega Plateau lies the Atlanta Plateau (See fig. 3.) a broadly rolling area that extends across Piedmont Georgia from the Valley to the Midland Slope and whose plateau surface lies 1,000 to 1,300 feet above the sea level. A few residual mountains, most of them rather large and high, stand above it, and it is traversed by several deep but rather flaring river trenches.

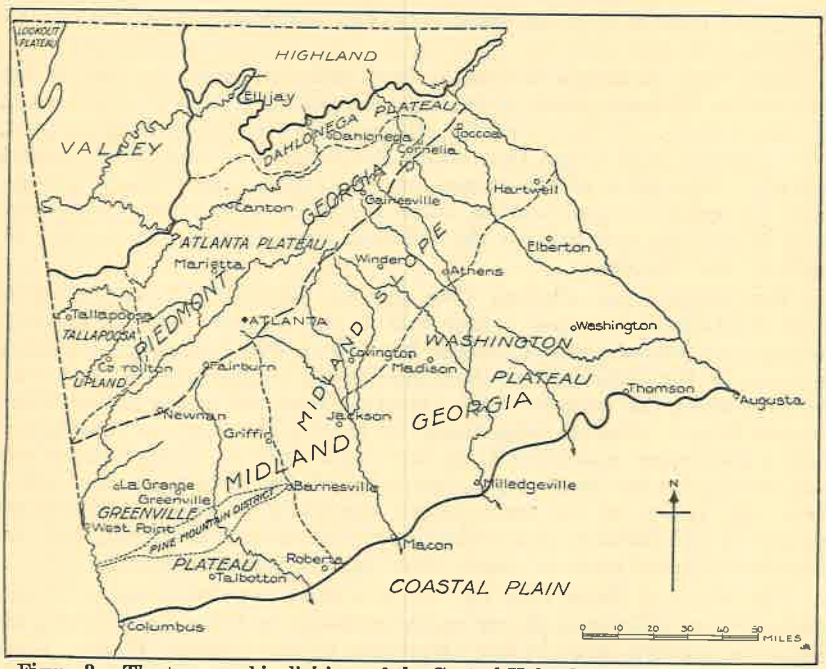


Figure 3. The topographic divisions of the Central Upland.

Southwest of the Atlanta Plateau the general altitude of the surfaces increases again to a fairly rugged upland that extends into Alabama, where it becomes almost mountainous along its western margin. This is the Tallapoosa Upland (See fig. 3.), whose surface, in Georgia, lies 1,100 to 1,300 feet above sea level but is rather more deeply and sharply dissected than that of the Atlanta Plateau. In this district residual summits bold enough to be called true monadnocks are few and small.

These three districts constitute Piedmont Georgia. Southeast of that section is another—Midland Georgia—which occupies the larger part of the Central Upland and in which three, possibly four, other districts are recognized. There are no topographic maps of

a large part of this section and detailed knowledge of its surface form is incomplete. If it were as well mapped as Piedmont Georgia possibly more districts would be distinguished.

Southwestern Midland Georgia—roughly all that part west of the divide between Flint and Ocmulgee rivers—is the Greenville Plateau (See fig. 3.) This is a nearly level plateau whose generally smooth surface lies 800 to 900 feet above sea level. Southeastward it descends to 600 feet and southwestward to 500 feet at the margin of the Coastal Plain. Except in the Pine Mountain district the plateau is almost unbroken by monadnocks, and it is not deeply dissected except along the valleys of Flint and Chattahoochee Rivers. Outside of the Pine Mountain district it is the most generally uniform part of the Central Upland.

The Pine Mountain district is very different from the rest of the Greenville Plateau, which it extends completely across a little south of the middle. It is a district characterized by long and, in part, very sinuous, bold ridges that stand 300 to 500 feet above the plateau surface. The sides of the ridges are steep and rough and the gorges that are cut through them in some places have a wild picturesqueness in striking contrast to the subdued character of the scenery of most of the Plateau.

The Washington Plateau (See fig. 3), occupies the southeastern part of Midland Georgia, nearly half of the section. It is a broadly rolling area whose general surface lies 600 to 800 feet above sea level in most of the district, but descends gently southeastward to about 500 feet along the margin of the Coastal Plain and in the valley of Savannah River. Graves Mountain, in Lincoln County, is almost the only conspicuous monadnock in the whole district, though there are half a dozen other small ones. In most of the area there are none. Near the valleys of the main rivers, especially toward the southern margin of the district, the surface is rather deeply dissected, but on the divides great areas of nearly level land extend for miles.

The Midland Slope (See fig. 3), is a belt 15 to 30 miles wide extending from Savannah River southwestward to Ocmulgee River and thence southward west of the Ocmulgee to the Coastal Plain. This belt lies between the Dahlonega Plateau, the Atlanta Plateau, and the Greenville Plateau on one side and the Washington Plateau on the other side, and across it the surface descends 300 to 600 feet from the higher districts on the north and west to the lower plateau on the southeast. A few small monadnocks stand above its surface, which, on the whole, is smooth, but is rather deeply cut by the valleys of the streams flowing southeastward across it.

The differences in the drainage patterns of the two sections of the Central Upland have already been briefly discussed. There are few individual peculiarities in the several districts, as in each of the sections the whole area, besides much adjacent territory, has the same general drainage pattern. All Piedmont Georgia, except its southeastern margin, is drained by four main streams with southwesterly courses roughly parallel to the structural trend but largely in-

dependent of the directions of slope of the upland surface. All Midland Georgia, with a fringe of Piedmont Georgia, is drained by six main rivers with southeasterly or southerly courses directly across the trend of the structure but in the direction of the general slope of the upland surface.

The Dahlonega Plateau is drained by short streams flowing down from the Highland in rather direct courses to the lower districts beyond. All these streams except some of those in the Coosawattee Basin flow southeastward across the northern part of the Atlanta Plateau and join the master streams nearly at right angles. The southern and western parts of the Atlanta Plateau are drained in several directions to Etowah and Chattahoochee rivers. The Tallapoosa Upland has its own drainage system, nearly all its surface water flowing southwestward to Tallapoosa River. Piedmont Georgia, therefore, shows little evidence of system in its present drainage pattern, except the fact that the main streams flow southwestward in the general direction of the structural trend.

In Midland Georgia, almost the only noticeable differences in the drainage patterns are those between the Greenville Plateau and the rest of the section. All the surface water of the Midland Slope and the Washington Plateau flows directly to the Atlantic through four main river systems. The surface is rather closely dissected by highly developed dendritic drainage and nearly all tributaries join the trunk streams at acute angles. Only a few of the larger ones flow for any considerable distance parallel to the structural trend and the courses of the minor ones are independent of the structure. The Greenville Plateau, however, is drained southward to the Gulf, through two river systems, and the surface is not so closely dissected as in the Washington Plateau. The drainage pattern in the Flint River basin is partly dendritic, but about half its tributaries flow nearly parallel to the structure Almost all those of the Chattahoochee from the Greenville Plateau flow parallel to the structural trend, but some have begun to develop dendritic patterns in the upper part of their basins.

These differences in the drainage patterns of the different parts of the Central Upland and the extension of those patterns into adjacent territory are among the most striking topographic features of Georgia. They must not be overlooked in discussing the topography, as they furnish important and critical evidence regarding its manner of development.

PIEDMONT GEORGIA

THE DAHLONEGA PLATEAU

The northernmost and highest sub-division of Piedmont Georgia is called the Dahlonega Plateau, from its extensive and typical development about Dahlonega, in Lumpkin County, where large areas of it can be well seen (See pl. XVIII-A), from points, like Crown Mountain, which stand slightly above the general upland level. This sub-division is an irregular belt stretching across the northern end of the Central Upland and bordering the southern margin of the Highland from the great escarpment on the west to the eastern boundary of the State. It ranges in width from more than 20 miles in western Gilmer and Pickens counties to only a few miles in western Dawson County and again on Tugaloo River. It is sharply cut off on the west by the escarpment and eastward it extends into South Carolina. Its northern boundary is the irregular and ill-defined southern margin of the Highland, and its southern boundary, although somewhat less irregular, is less well defined and is not easily represented by a line. This boundary begins at the gorge of Pinelog Creek, in western Cherokee County, and extends in a general northeasterly direction past Tate and Dawsonville and a little south of Dahlonega and Cleveland to a point near Clarkesville, where it loops back southwestward around Alto and thence extends nearly directly northeastward to Tugaloo River.

The Dahlonega Plateau is an irregular bench or platform lying at the base of the mountains and overlooking the lower country on the southeast and southwest. Throughout much of its extent its plateau character is well preserved and is well seen from commanding points, such as Crown Mountain, near Dahlonega, but where the hills and mountains standing above the general surface are numerous and the valleys cut below the general level are sharp and deep the true character of the district as a plateau is nearly obscured.
The general level of the upland surface is 1,600 to 1,800 feet above sea level. Although it stands several hundred feet higher than the Atlanta Plateau on the south and overlooks that plateau, the two districts are not separated by an escarpment or by a relatively steep and clearly defined slope, but by an irregular belt of broken country across which the surface descends from one to the other. Northeast of Alto, however, where the district is bounded on the southeast by the Midland Slope, the two are separated by an abrupt though rather irregular escarpment about 500 feet high which is one of the prominent features of that part of the State.

The rocks of the Dahlonega Plateau are wholly crystalline and have been greatly deformed, hence the structure is highly disordered. They comprise a number of types that differ considerably in their resistance to erosion and these differences have affected the development of the minor details of the topography. There is, however, no general relation between the broader features of the surface and

Photographs (A) By Arthur Keith, (B) by J. P. D. Hull, and (C) by Laurence LaForge.

A. DAHLONEGA PLATEAU LOOKING EAST FROM CROWN MOUNTAIN, DAHLONEGA.
B. CRUMPLING OF CLAY RESIDUAL FROM SHADY LIMESTONE UNDER ACTION OF GRAVITY ON A STEEP SLOPE.
C. SPHEROIDAL WEATHERING OF A TRAP DIKE.

the kind of rock on which they are formed, and these broader features seem to have been controlled mainly by the course of events during the development of the topography. This was developed entirely by erosional processes affected to a minor extent by the structure. The development has extended through several cycles, separated by uplifts that were possibly accompanied by a slight warping of the surface, but not by strong deformation of the rocks. It seems probable that throughout its history the district has been at or near the heads of the streams, where erosive processes went on vigorously and the resulting surface form was strongly marked. This should be remembered in interpreting the following description.

In the western part of the district the axis of the Burnt Mountain salient of the Highland is prolonged southwestward in the Sharp Mountain range of Pickens County, and in the eastern part the group of large outlying mountains in White County is a sort of prolongation of the similar but less pronounced salient of the Tallulah Mountains. Because of these broader irregularities in form the district can best be treated as comprising several minor subdivisions, which are not sufficiently important to be named, but are recognized chiefly for convenience in description.

The westernmost of the minor districts comprises that part of the Dahlonega Plateau lying in the drainage basin of Coosawattee River. It forms a lobe of the Central Upland extending northeastward between the Cohutta Mountain salient of the Highland on the northwest and the Burnt Mountain salient on the southeast. It is continuous through the gap at Blue Ridge with the Ducktown Plateau of the Highland province. Its western margin is well defined by the escarpment facing the Valley and it is almost shut in on the other sides by mountains. Its general upland surface, which is rather uneven, lies 1,500 to 1,800 feet above sea level and is so deeply cut by narrow, steep-walled valleys that its true character as a dissected plateau is evident only from a few commanding points. Throughout most of the length of the escarpment along the western margin the upland surface is a little higher than it is a few miles back in the Plateau, but this difference is not marked. In the southeastern part of Gilmer County Talona Mountain and a few other small masses stand 500 to 800 feet above the general upland surface.

The northern part of the area is drained directly to Coosawattee River, which is formed by the junction, at Ellijay, of Ellijay and Cartecay Rivers. The Coosawattee flows in a tortuous trench which is 300 to 600 feet deep, has steep walls and is for the most part very narrow, with practically no flood plain. This trench is one of the striking features of the area. North of the Coosawattee the surface is rough and hilly and the valleys are deep and narrow, but in the southern part of the area, especially in Pickens County, the upland surface is broadly rolling and the valleys are mainly shallow and rather open. Two parallel small valleys, separated by a ridge about 300 feet high, extend southward from Ellijay to Talking Rock and constitute almost the only part of the district in which the topography

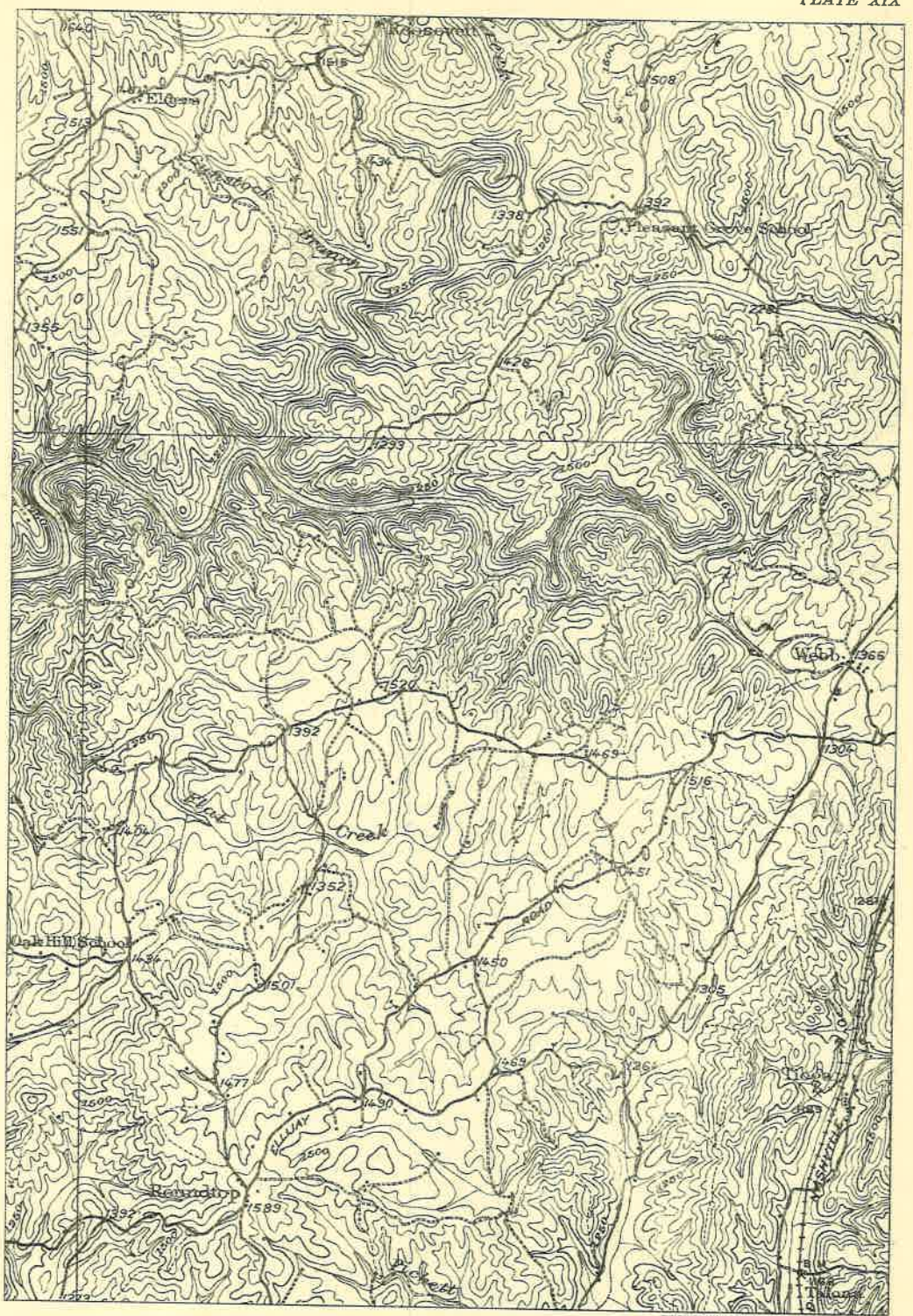
reflects the rock structure, although traces of the same structural control are revealed in the valley extending northeastward from Ellijay toward Blue Ridge. The eastern one of these two valleys affords an easy route through the district and across the Blue Ridge divide that has been utilized by a railroad line and by a main highway. The topographic character of this part of the district is illustrated by Plate XIX.

The area is rather sparsely settled and a large part of it is still in woodland. The only town of importance is Ellijay, the county seat of Gilmer County. It is adjoined on the southeast by East Ellijay, which is the railroad point and a lumber manufacturing town. The two are situated at the broadest place in the longitudinal valley, where Ellijay and Cartecay Rivers unite to form Coosawattee River, and where the natural routes of travel from several directions converge and cross.

The area just described is separated from the next sub-division by the bold ridge of Sharp Mountain, which extends from a point 3 miles west of Jasper southwestward for about 8 miles (See Pl. XXXII-B.) At the northeast it is separated by a gap of only 5 miles from a western spur of Burnt Mountain, and on the southwest by a gap of only 2 miles from the bold range of Pinelog Mountain. Sharp Mountain is, on the whole, a linear ridge, though it has several prominent spurs on both sides, and its crest is distinctly toothed. Near its northeastern end is a bold conical knob which stands more than 2,400 feet above sea level and is one of the conspicuous land marks of Pickens County.

Sharp Mountain, Burnt Mountain and Pinelog Mountain form the divide between the drainage basins of Coosawattee and Etowah Rivers. Jasper, the county seat of Pickens County, is situated in the gap between Burnt and Sharp mountains, and on a spur of the Dahlonega Plateau just east of the main divide, so that it is easily accessible by railroad and by main highways converging from all parts of the county. Other small areas of the Dahlonega Plateau form the upland surface southwest of Jasper and in the southeastern corner of Pickens County, but most of the county southeast of the divide lies in the belt of broken country where the surface descends to the Atlanta Plateau.

The next sub-division of the Dahlonega Plateau is an irregular bench lying at the base of the Blue Ridge escarpment and extending northeastward from Burnt Mountain to the Tallulah Mountains. Its upland surface lies at a general altitude of 1,500 to 1,800 feet but is deeply trenched by the valleys of the streams that flow across it to the Etowah and Chattahoochee valleys on the southeast. It is not sharply separated from the Atlanta Plateau on the south, but merges into that plateau by a general descent of the upland surface from one district to the other. On the east it is separated by the valley of Soque River from the next sub-division to be described. In Dawson County and the southwestern part of Lumpkin County the upland surface is not much broken by residual eminences, but else-



Part of the Talking Rock sheet

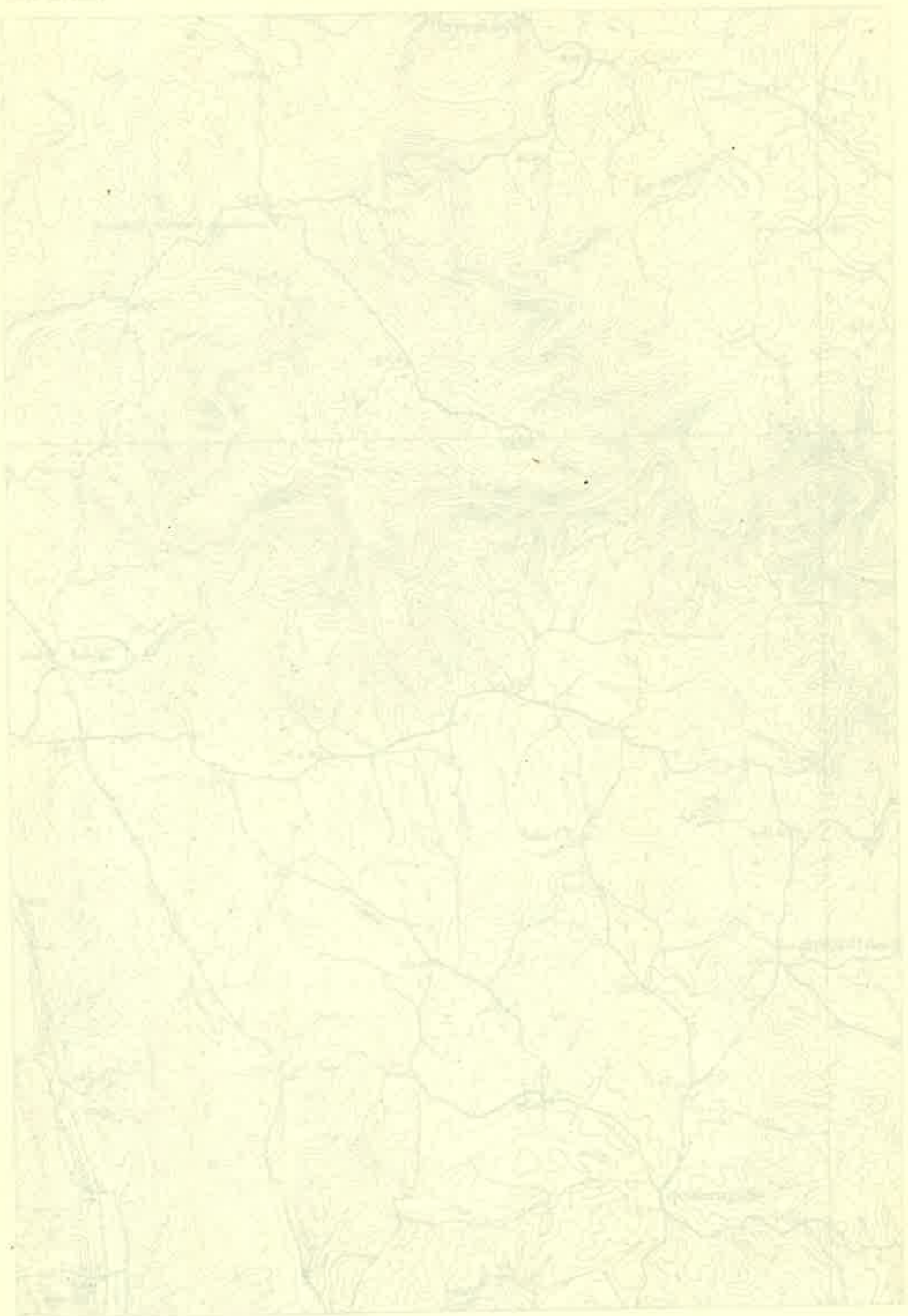
THE DAHLONEGA PLATEAU SOUTHWEST OF ELLIJAY

Scale $\frac{1}{62500}$

1 ½ 0 1 2 Miles

Contour interval 50 feet

Datum is mean sea level



where they occupy much of the surface and give the country the aspect of a belt of foothills rather than that of a plateau. The plateau is well developed, however, in the broad valleys of Chestatee, Chattahoochee, and Soque Rivers (See pl. XVIII-A.) This sub-division is, therefore, truly a piedmont area, almost the only one in Georgia.

As just stated, monadnocks are numerous in this district, especially in White and Habersham Counties. Three of them, Yonah, Pink, and Walker mountains, stand more than 2,500 feet above sea level. The summit of Mt. Yonah—one of the most picturesque and famous mountains in the State (See pl. XX-A)—attains an altitude of 3,173 feet and is the highest point in the Central Upland of Georgia. The view from it is reputed to be the finest in the State. Surrounded as they are by broad stretches of plateau and valley lying for the most part below 1,600 feet, these mountains, together with Sal, Pine, Skitt, and Lynch mountains, are among the most conspicuous features of northern Georgia. They are all visible from the Main Line of the Southern Railway on a clear day and they add greatly to the attractiveness of the view in that direction from the trains, especially if, as is sometimes the case, they are seen against the background of the great wall of the Blue Ridge in the remote distance, as they are shown in plate XXX-A.

In striking contrast to the conspicuous monadnocks of the district are the broad, level-bottomed, and highly fertile Sautee, Nacoochee, and other valleys. The Nacoochee Valley in particular is far-famed for its beauty, which has been celebrated in song and legend, dating back even to the days of the early Spanish explorers. A well-known Indian mound still remains at its western end, and this picturesque spot and the towering precipice of Mt. Yonah, which overlooks it on the south, are the scene of many of the romantic Cherokee Indian legends. A view of part of the Nacoochee Valley is shown in pl. XX-B and its topographic surroundings are shown in pl. XVIII.

Because of the fertility of its broad valleys, the beauty of its scenery, and its mineral wealth, formerly more important than now, this part of the Dahlonega Plateau is more generally cleared and more thickly settled than the other parts. It is penetrated by only one railroad, the Gainesville and Northern, which extends northward through Cleveland to the lumber mills at Robertstown and Helen, situated where Chattahoochee River emerges from the mountain gorge at its head. The area is crossed, however, by several of the main highways that extend northward across the Blue Ridge into the Highland. Dahlonega, the county seat of Lumpkin County and the chief town of the district, was, a century ago, the most important gold mining town in the United States. The gold mines are now nearly all abandoned, but the town still retains considerable importance as a summer resort and as an educational center. Cleveland is the county seat of White County and is growing in importance as a market town since the construction of the railroad.

The easternmost division of the Dahlonega Plateau is the bold upland that lies southeast of the Soque Valley and forms the divide

between the basins of the Soque and the Tugaloo. This upland is part of what is called the Chattahoochee Ridge. That name, however, is ordinarily rather loosely applied to the divide bounding the drainage basin of the Chattahoochee on the southeast and is often used as far southwest as Atlanta or even beyond there, whereas the upland here described extends southwestward only a few miles beyond Alto. Its surface lies at a general altitude of 1,400 to 1,600 feet and descends slightly northwestward toward the valley of Soque River and the base of the Tallulah Mountains. It is bounded on the southeast by a bold but rather irregular escarpment where the surface descends about 500 feet in a few miles to the Midland Slope. Southwestward the surface descends more gradually to the Atlanta Plateau.

Only one monadnock of importance stands above the general level of this part of the plateau—Griffin Mountain, just south of Cornelia. Although its summit is only a little more than 1,800 feet above sea level, the view from it is probably not exceeded in extent and in the variety of topography displayed by that from any other point in Central Upland, except possibly Mt. Yonah. Situated as it is on the southeastern margin of Piedmont Georgia, Griffin Mountain commands an extensive prospect of the eastern part of Midland Georgia on the southeast and south. On the north and northwest the eye ranges across the width of the Dahlonega Plateau, with Mt. Yonah and the other monadnocks of White and Habersham counties in the middle distance and the Tallulah Mountains at the right. Still farther, beyond the Sautee and Nacoochee valleys, is the great escarpment of the Blue Ridge, several of the highest peaks of which can be seen on a clear day. A part of this view to the northwest is shown in pl. XXX-A.

The escarpment that bounds this part of the Dahlonega Plateau on the southeast is deeply trenched by the short, swift streams that flow down it and the scenery here is rather different from that elsewhere in the district. The Main Line of the Southern Railway climbs the scarp from Ayersville to Mt. Airy, where it attains the upland and begins the long descent to Atlanta. No extensive views are presented to the traveler along this stretch, but the wild mountain gorges in the escarpment are extremely picturesque. After the train passes Cornelia on the other side of the divide, however, extensive and attractive views of the region on the northwest are seen from the trains at several points.

Much of this eastern part of the Dahlonega Plateau is a rather rugged and wild country, thinly settled and only partly cleared. This is well illustrated by the view shown in pl. XXX-B, of the Tallulah Gorge, at the northeastern end of the district. Its western side, however, descends to the fertile Soque Valley, where there are several important towns along the line of the railway extending from Cornelia northward past Tallulah Falls and into North Carolina. Cornelia, at the junction with the Southern Railway, is the most important town in the area. Demorest, the site of Piedmont College, is situ-

Photographs by S. W. McCallie.

A. MT. YONAH FROM NACOOCHEE VALLEY.
B. NACOOCHEE VALLEY.
C. CANE CREEK FALLS, LUMPKIN COUNTY.
D. TALLY MOUNTAIN, NEAR TALLAPOOSA.

ated a few miles to the north, and Clarksville, the county seat of Haberham County, is a pretty town a little farther up the line. Mt. Airy, just east of Cornelia and on the crest of the divide, is a popular summer resort. Besides the two railroads mentioned this part of the Dahlonega Plateau is crossed by the main highways that penetrate the northeastern counties of the State.

The greater part of the Dahlonega Plateau is drained to the Chattahoochee, either directly or through Chestatee, Soque, and Sautee Rivers. The eastern end is drained by short streams flowing to the Tugaloo, and the western end is in the basin of Coosawattee River, though some of the streams that drain this part, especially Pinelog and Sallacoa creeks, flow well out into the Valley before they join the master stream. That part of the plateau lying in eastern Pickens, Dawson, and western Lumpkin counties is drained by Etowah River and its tributaries.

Except in the part drained to Tuga'oo River the general course of the drainage is, therefore, southwesterly, and some portions of the main streams, especially in White and Habersham counties, flow in nearly straight southwesterly courses parallel to the trend of the structure. Other streams flow southeastward and join the first ones nearly at right angles, hence there are some traces in the district of a trellised drainage pattern, but it is not very conspicuous, and the drainage pattern of most of the area is rather unsystematic. There are many small cascades in the district, two of them being pictured in pls. XX-C and XXIII-B.

THE ATLANTA PLATEAU

The Atlanta Plateau, which is named from the capital city and metropolis of the State, situated on the Plateau near its southeast margin, occupies the central part of Piedmont Georgia. The district is a broadly rolling upland that extends for miles southward and southwestward from the belt of broken country that bounds the Dahlonega Plateau on the south, and is about 50 miles wide in its widest parts and more than 100 miles long. It is bordered on the north and northeast by the Dahlonega Plateau, on the southeast by the Midland Slope and the Greenville Plateau, and on the west by the Tallapoosa Upland and the Valley. Its margin facing the Valley is marked by the escarpment already mentioned several times, but the boundary between the Plateau and the Tallapoosa Upland is indefinite and is a zone of merging rather than a line.

The Atlanta Plateau comprises two fairly distinct plateaus or platforms, which differ in altitude by about 250 feet. The higher one occupies the northern and northeastern parts of the district and the lower one most of the remainder. They are not separated by escarpments, but by broad slopes descending from one to the other, nevertheless each is distinctly a separate plateau and they clearly lie at different altitudes. The general altitude of the higher one is 1,300 feet or more and that of the lower one is from 1,000 to 1,100 feet. The higher one is named the Gainesville platform, from its

development about Gainesville, especially just east and southeast of that city. The lower one is named the Fairburn platform, from its development on the main divide near Fairburn. So far as been determined, the altitude of the Gainesville platform is about the same throughout its extent. The Fairburn platform seems to be highest along a line drawn through Suwanee and Kennesaw mountains and to descend somewhat both northwestward and southeastward from that line. Large areas of the upland surface in Bartow, Cherokee, and Cobb counties lie below 1,000 feet, yet they seem to be parts of the Fairburn platform.

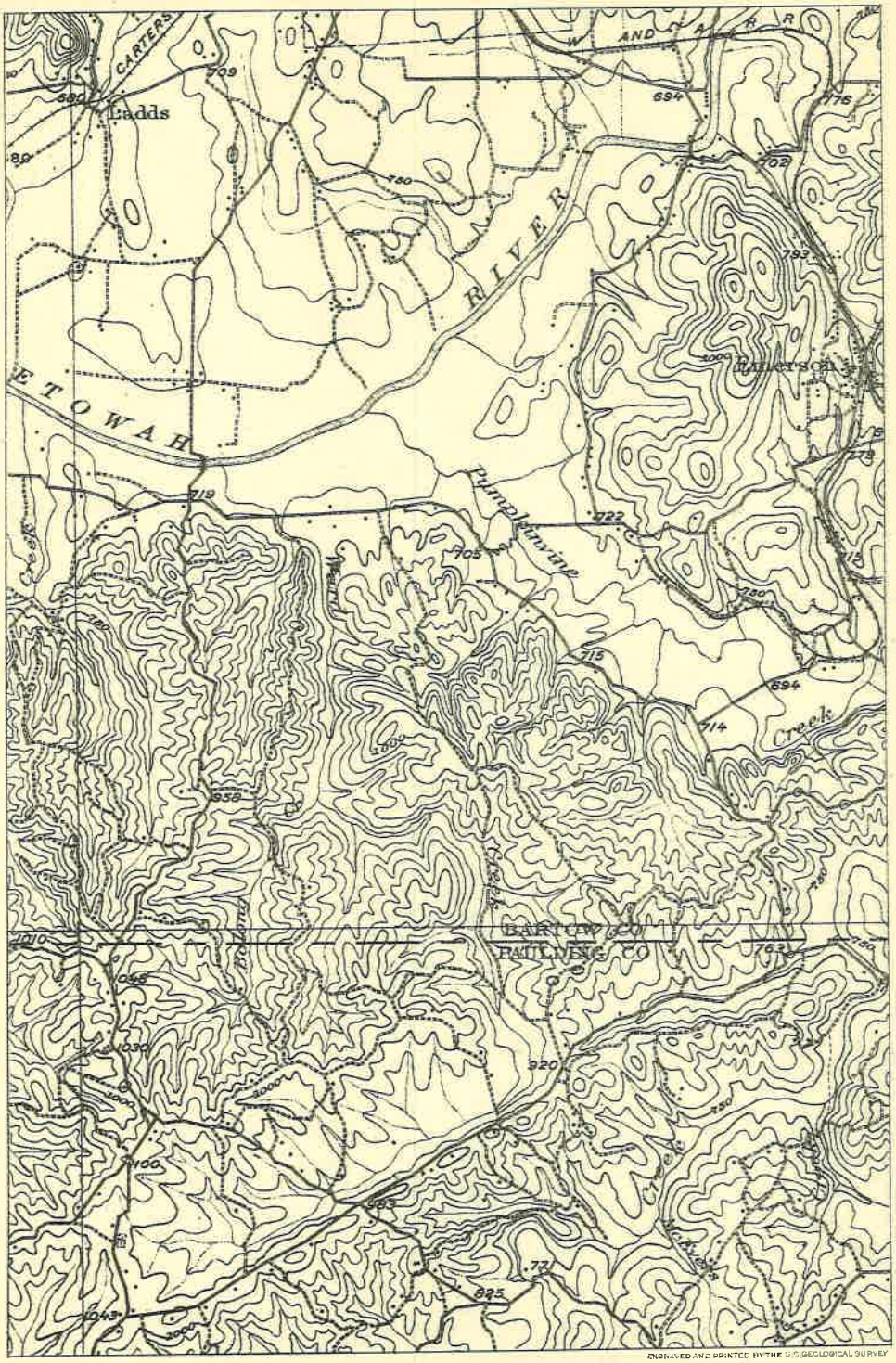
The rocks and geologic structure of the Atlanta Plateau are in all respect similar to those of the Dahlonega Plateau and nearly all the geologic formations of one district extend into the other. The same is true of the relation of the surface form to the structure and the same general statements regarding the development of the surface form hold true in both districts.

Considered, as a whole, the Atlanta Plateau is topographically a rather homogeneous district, as, with only minor exceptions, there are no striking differences in topography in its different portions, hence there are no important minor morphologic divisions. For convenience in description the district may be regarded as being divided longitudinally into three parts by Chattahoochee and Etowah rivers, both of which flow southwestward along its length.

The northwesternmost and smallest of the three sub-divisions just mentioned, lying northwest of Etowah River, has so much relief and is so much dissected by valleys that its true character as part of a plateau is obscure. For these reasons, however, its scenery is more picturesque than that of other parts of the district, and it is less cleared and less densely settled.

This part of the district is occupied mainly by the higher or Gainesville platform, considerable remnants of which are preserved in northern Cherokee and central Dawson counties. This platform merges northward and northwestward into the broken, hilly country by which the surface ascends to the Dahlonega Plateau. An area in western Cherokee County and the adjacent part of Bartow County is occupied by a group of hills and mountains. The chief of these, Pinelog Mountain, is the largest and, because of its situation at the edge of the Upland, perhaps the most conspicuous monadnock in Georgia, though by no means the highest, as the altitude of its summit is only a little more than 2,300 feet. Southward from Pinelog Mountain a chain of hills and small mountains whose summits stand 1,000 to 1,800 feet above sea level extends to Pumpkinvine Creek, a few miles beyond the Etowah. East of the hills, between them and the river, is an area in which most of the upland surface is part of the lower or Fairburn platform, very little of which is developed elsewhere north of the Etowah.

The main valleys of this part of the district are several hundred feet deep and sharply cut, so that the area, as a whole, gives an impression of being a distinctly hilly region, rather than part of a plateau.



Part of the Stilesboro sheet

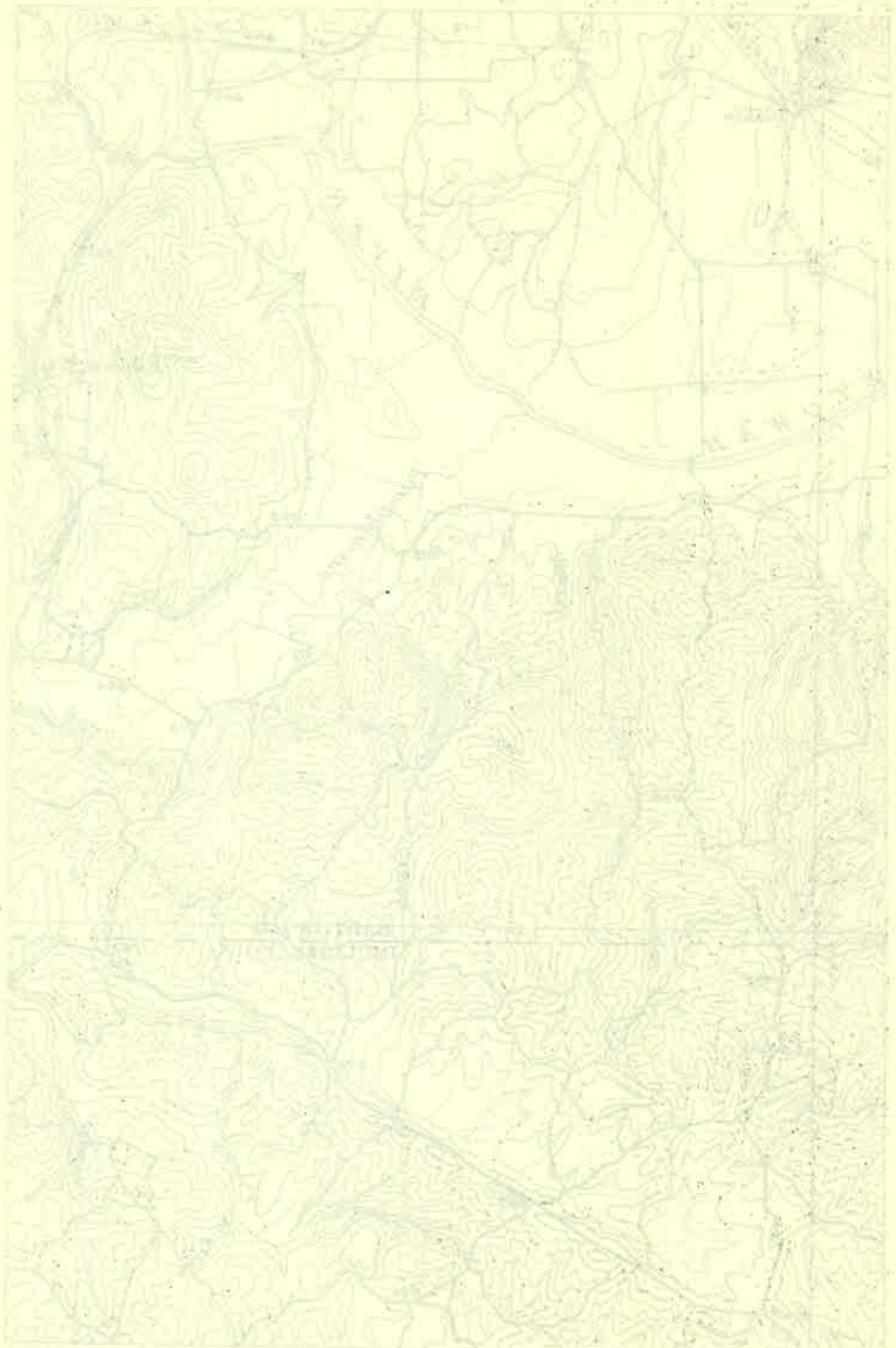
THE VALLEY AND THE MARGIN OF THE ATLANTA PLATEAU SOUTH OF CARTERSVILLE

Scale $\frac{1}{62500}$

1 Mile

Contour interval 50 feet

Datum is mean sea level



The largest and most important valley, that of Long Swamp Creek, has a flat bottom a quarter of a mile or more wide, which has been opened out by the stream along a belt of marble. Along the west side of this marble belt, but on the upland surface, where the railroad was built, are situated the only important towns, Tate, Nelson and Ballground. These are dependent largely on the marble industry, at present one of the most important mineral industries of the State.

The next sub-division of the Atlanta Plateau is the belt, 10 to 25 miles wide, that lies between Etowah and Chattahoochee Rivers and extends southwestward the entire length of the district. Except at its northeastern end, which lies wholly in the Chattahoochee basin, the divide between the two rivers lies approximately in the middle of the belt, which thus has the general form of a broad upland, highest along its central line and declining somewhat toward both sides. At its northeastern end this upland merges into the hilly country bordering the Dahlonega Plateau. Southwest of this border zone, the greater part of the upland in Hall, Dawson, and northern Forsyth counties is part of the Gainesville platform, which is well preserved in this area. The remainder of the sub-division is occupied chiefly by the Fairburn platform, but at its southwestern end it merges into another area of broken country where the general level of the surface ascends again to the Tallapoosa Upland. In the basin of Sweetwater Creek, in Cobb County, and in that of Allatoona Creek, in Cobb, Bartow and Paulding counties, large areas of the upland surface lie at 1,000 feet or less above sea level, but they appear to be parts of the lower platform.

The most striking features of this part of the Atlanta Plateau are the mountains which are scattered at intervals along a nearly straight line extending southwestward from Skitt Mountain, at the edge of the Dahlonega Plateau, in northern Hall County, to Lost Mountain, in Cobb County. The largest and most important of these are Suwanee Mountain, in Forsyth County, and Sweat and Kennesaw mountains, in Cobb County, the last named being one of the most famous mountains in the State. In some parts of this line the adjacent hills or mountains are not far apart, but in other places they are separated by gaps of 12 to 15 miles. Southwest of Chestatee River, which joins the Chattahoochee, these mountains stand on or close to the main divide traversing this section of the Plateau. Several smaller residual eminences stand a few miles to one side or the other of the line, but in most of the rest of this sub-division there are no true monadnocks. The characteristic topography of a small part of the Plateau near its northwest margin is shown in pl. XXI.

As much of the surface is fairly smooth, this part of Piedmont Georgia is more largely cleared and more generally settled than the parts already described and small towns and villages are situated in all parts of it. Most of the sub-division, however, is out of the main lines of travel and there are no railroads, except those radiating westward and northwestward from Atlanta, and few cities. The most important cities are Marietta, Canton, and Douglasville, in all of

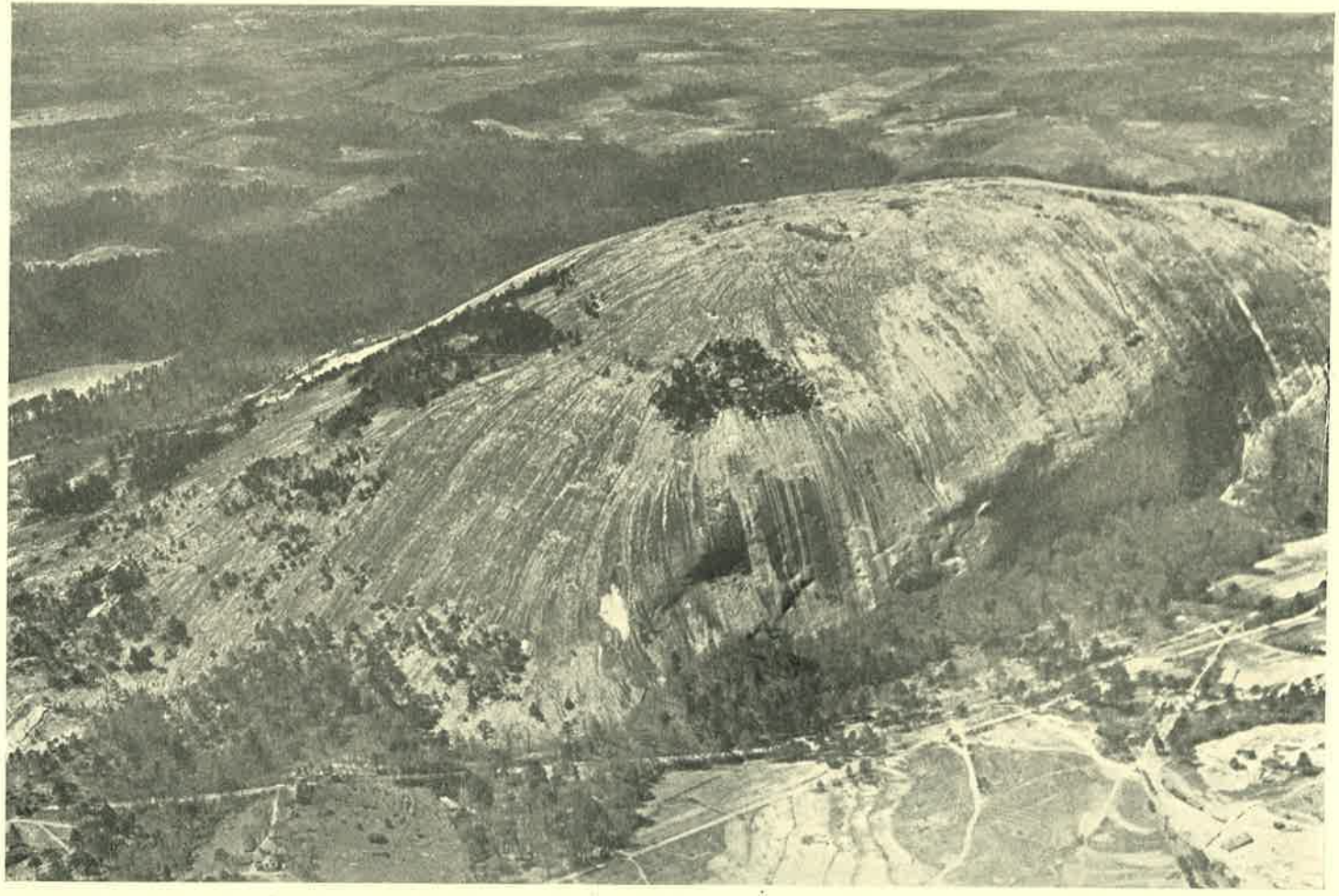
which there is some manufacturing. A characteristic feature of the settlement of the region is the fact that, except Canton, which is on Etowah River, all the cities and larger towns are on the upland and away from the rivers and larger valleys.

The third division of the Atlanta Plateau lies southeast of Chattahoochee River and includes a northeast-southwest belt, from 6 to 15 miles wide and a little more than 100 miles long, between the river and the southeastern boundary of the Plateau. Northeastward it merges into the Dahlonega Plateau in an irregular hilly tract in eastern Hall County. Its southwestern termination is indefinite, but it appears to die out in western Coweta County, where it may descend to merge into the Greenville Plateau. Like the central division, it is a rolling upland that is highest along an axial line and whose surface descends gradually in both directions from that line. It is unlike that division, however, in that it also decreases steadily in altitude from northeast to southwest.

The southeastern boundary of the Atlanta Plateau is part of the boundary between Piedmont Georgia and Midland Georgia. From eastern Hall County southwestward this line is rather indefinite and not easily determined. In general, however, it is marked by a change in the attitude of the upland surface from the nearly level Atlanta Plateau to the slope descending to the lower country on the southeast. This line of change in slope is approximately parallel to the divide between the tributaries of the Chattahoochee and the streams flowing directly to the Atlantic, but it is everywhere a few miles southeast of the divide. This is because the streams flowing to the Atlantic are slowly encroaching on the others through headward growth and are shifting the divide northwestward. They do not lower the surface about their heads as rapidly as they are growing headward, hence the line of change of slope is not being shifted northwestward to keep pace with the divide, although probably the two lines coincided in position when the shifting began.

In the northeastern part of the sub-division, in Hall County, are several areas of upland that are remnants of the higher or Gainesville platform of the Atlanta Plateau. There are, also, some rugged areas, especially one south of Flowery Branch, that stand above the level of that platform, but are not sufficiently pronounced to be called monadnocks. Southwest of Hall County the upland surface is mainly part of the Fairburn platform, which descends southwestward very gradually to only a little more than 1,000 feet about Newnan, beyond which place there are no topographic maps of the area. Scattered irregular tracts of rougher country, due to more resistant rocks, rise above the upland here and there as far southwest as northern Clayton County.

The only true monadnock in the sub-division is the famous Stone Mountain, in DeKalb County. This great boss of rock, one and one-half miles long, three-fourths of a mile wide, and rising 650 feet above the upland about its base, is a typical granite dome, such as are common in some parts of the country, but are rather rare in Georgia.



Photograph by U. S. Army Air Service.

AIRPLANE VIEW OF STONE MOUNTAIN, LOOKING SOUTHWEST.

The mountain owes its shape to the process of weathering known as exfoliation (See pl. XXIII-A), and its sides are now so steep and its top so well rounded that the loose material formed by the slow breaking down of the granite under the action of the weather, is washed away or blown away almost at once and does not accumulate to form soil. There is, therefore, little vegetation on the mountain, which is a huge, light gray dome of almost wholly bare rock and a conspiciuous object in the landscape, as can be seen from the airplane photograph shown in pl. XXII. Because Stone Mountain stands so entirely alone and rises above a rather smooth upland, the view from its summit, although the eye ranges over hundreds of square miles of the upland, is impressive only for its extent and is otherwise rather monotonous. On a clear day several of the lone mountains of Cobb and Forsyth counties can be seen, and these and the tall office buildings of Atlanta, 16 miles to the west, are almost the only objects that break the uniformity of the sky-line.

This southeastern division of the Atlanta Plateau, like the central one, includes so much relatively smooth and level upland that it is largely cleared and rather densely settled. The Southern Railway runs approximately along the main divide from Mt. Airy to Atlanta, beyond which city the Atlanta and West Point Railway continues on the divide to Newnan. Along this line are situated the chief cities of the subdivision: Atlanta, Gainesville, Newnan and East Point. Other railroads radiate from Atlanta and main highways reach all parts of the subdivision, which is rather thickly dotted with small cities and large towns.

Except in the narrow strip along its southeastern margin where the streams flow to the Atlantic, the drainage of the Atlanta Plateau is carried entirely by Chattahoochee and Etowah Rivers. Both streams flow southwestward approximately parallel to the trend of the geologic structure, but the Etowah turns westward, breaks through the bold hills at the western margin of the Plateau and flows across the Valley to join the Oostanaula to form the Coosa. The Chattahoochee, on the other hand, turns southward across the Coastal Plain directly to the Gulf. In the western part of the Plateau, where the general surface rises somewhat toward the Tallapoosa Upland, Pumpkinvine and Raccoon creeks, tributaries of the Etowah, and Sweetwater Creek and Dog River, tributaries of the Chattahoochee, flow eastward or northeastward for much of their length before turning to join the main streams. The existence of this "back-handed" drainage, as it is called, and its relation to the general slope of the upland, throw light on the probable sequence of events during the development of the drainage and the surface form.

One of the most important and striking topographic features of the Atlanta Plateau is the great trench of Chattahoochee River, which flows the entire length of the district on a nearly direct southwesterly course. Although rather sinuous in some places, especially in the stretch where it crosses the 34th parallel five times in a few miles, the course of the Chattahoochee in the Atlanta Plateau is remarkably

straight compared with those of the other large rivers of Georgia. The stream flows in a trench from 150 to 400 feet or more in depth and from 2 to 5 miles wide from rim to rim. For a little distance below Roswell the trench is practically a gorge, but nearly everywhere else there is some flood plain, nowhere more than half a mile or so in width and generally only a few hundred yards wide. Below the mouth of Peachtree Creek there are remnants of terraces here and there, but, owing to the lack of good topographic maps and of detailed observation, no definite statements can be made regarding them. In several places, too, there are strong indications that the valley is double, consisting of a deeper narrow valley cut in the floor of a wider, high-level valley, but on this point again, owing to the lack of detailed information, no positive statements can be made.

One of the striking features of the Chattahoochee valley in its course across the Atlanta Plateau is the narrowness of the drainage basin of the river compared with its length. This basin extends almost across the State, from its northeastern end only 5 miles from Tugaloo River for 150 miles southwestward to the Alabama State boundary. Except near its head, where it receives the drainage of the southern slope of part of the Blue Ridge through Chestatee and Soque Rivers as well as through its own head-waters, Chattahoochee River is joined by no important stream in its course across the State and most of its tributaries are short and small. Hence the divides bounding its basin are fairly close to the river and the basin is nowhere more than 30 miles across and in some places only 10 miles. Nevertheless the river has cut its valley to such a depth that its trench is, as stated above, one of the notable topographic features of the Atlanta Plateau.

THE TALLAPOOSA UPLAND

The southwestern part of Piedmont Georgia is comprised in the district named the Tallapoosa Upland, from the town of Tallapoosa, in Haralson County. The district is distinctly an upland, standing above the surrounding country on all sides, and having a diversified surface, partly smooth plateau, partly rugged hills, and partly, especially in Alabama, mountainous. It is bounded on the north by the Valley, from which it is separated by the great escarpment, here trending nearly eastward and facing northward, already described as the northwestern boundary of Piedmont Georgia. On the east it is bordered by the Atlanta Plateau, from which it is separated by a slope several miles wide, too irregular and gentle to be called an escarpment. On the southeast the Upland is bordered by a strong slope, almost pronounced enough to be called an escarpment, descending to the lower country through which Chattahoochee River flows. Westward the Upland extends some distance into Alabama.

Much of the surface of the Upland seems to be part of the same higher platform, at about 1,300 feet above sea level, of which many remnants are preserved in the Atlanta Plateau, where it is called the Gainesville platform. Other parts of the surface have been cut below

Photographs by S. W. McCallie.

A. SOUTHWEST SLOPE OF STONE MT. SHOWING EXFOLIATION CRACKS.
B. FALLS OF SOQUE RIVER.

that level and a considerable area in the basin of Little Tallapoosa River seems to be a part of the lower or Fairburn platform, lying between 1,000 and 1,100 feet above sea level. A few small knobs stand well above the general surface, but there are no definitely mountainous tracts in the Georgia portion of the district.

The geologic formations of the Tallapoosa Upland, at least of the part of it in Georgia, are essentially the same as those of the rest of Piedmont Georgia, and they have been deformed in the same fashion. The district has, therefore, essentially the same structure as the others described. Its surface has been developed in the same manner as that of the rest of the section and the development of surface form has been affected to about the same degree by the rocks and structures. Its story, therefore, is practically the same as those of the other districts.

There are no well marked topographic subdivisions of the part of the Tallapoosa Upland in Georgia. Except its northern and southeastern margins the whole district is drained by Tallapoosa and Little Tallapoosa Rivers, which flow southwestward in roughly parallel courses into Alabama, where they eventually unite. Hence, viewed broadly, the district may be regarded as made up of three upland divides, partly separated by the two river valleys, but uniting at their eastern ends into the main divide between the streams flowing southwestward across the Upland and those flowing eastward into the Atlanta Plateau.

The northern stretch of upland extends from the crest of the boundary scarp, here only 200 to 300 feet high, southward to Tallapoosa River. Its surface is, in general, higher along the crest of the scarp and slopes gently southward, and the divide, which in general traverses the highest ground, is known locally as Dugdown Mountain. The streams that flow northward into the Valley and are tributary to Coosa River are busily engaged in breaching the scarp. Some of them have cut great gulfs in its face, but nowhere in Georgia do any of them appear to have cut through so as to tap any of the drainage on the back slope. On the other hand, one small tributary of the Tallapoosa still rises on the northern slope, just north of Felton, sweeps in a semicircle, and flows southward through the higher ground to the river.

The central stretch of upland, lying between the two rivers, has a more diverse surface, consisting of an irregular and sinuous central ridge, flanked on both sides by smoother upland areas. Scattered over the area are about a dozen irregular tracts of rougher country standing somewhat above the general surface, but only a few of them are sufficiently bold to be classed as monadnocks. Of those only two, Reeds Mountain, east of Bremen, and Tally Mountain, southeast of Tallapoosa (see pl. XX-D), are high enough to be conspicuous as landmarks. Several of these knobs stand almost directly in the prolongation of the line of mountains crossing the central part of the Atlanta Plateau, as described in a previous section, but this apparent relation in position may be purely fortuitous.

The southern stretch of upland is neither so smooth as the northern stretch nor so strongly diverse as the central one. The general upland surface along its axis stands 1,100 to 1,200 feet above sea level and rises in places to 1,300 feet. Only one definite monadnock, Blackjack Mountain in the southwest corner of Carroll County, stands well above the general level. The higher tracts along the divide are presumably remnants of the upper platform of the Atlanta Plateau, but they are rapidly being cut away by the short vigorous streams that flow southeastward to the Chattahoochee. These streams are actively contesting for possession of the divide with those flowing northwestward to Little Tallapoosa River, and the result is that the upland surface is more completely dissected than in other parts of the district. Along the eastern margin of the Upland there appears to be a similar contest between the tributaries of Tallapoosa and Little Tallapoosa rivers and the streams flowing eastward into the Atlanta Plateau. The eastward-flowing streams appear to have the advantage and already to have made several breaches in the eastern wall of the Upland.

The Tallapoosa Upland is a district of such diverse surface conditions that it is fairly well cleared in some portions and but little so in others. Although crossed by two main railroads, most of the district is rather remote from through routes and there are but few large places, the chief ones being Carrollton, Tallapoosa, Villa Rica and Bowdon, all of which have some manufacturing. As in most parts of the Atlanta Plateau, the settlements are nearly all on the upland and there are no large towns in the valleys.

MIDLAND GEORGIA

THE GREENVILLE PLATEAU

The westernmost and highest district of Midland Georgia is named the Greenville Plateau, from Greenville, the county seat of Meriwether County, near which place the characteristic topography of the district is well displayed. The district is bordered on the north by the Tallapoosa Upland and the Atlanta Plateau, on the east by the Midland Slope, and on the south by the Coastal Plain. Westward it extends into Alabama a considerable distance. Along the southeastern margin of the Tallapoosa Upland the surface descends several hundred feet in a few miles to the level of the Greenville Plateau, which may be regarded as extending to the base of the slope. Owing to lack of detailed information, the position and character of the boundary between the Greenville Plateau and the Atlanta Plateau in Coweta County is uncertain, and one district may merge into the other, in the unmapped area in the northern part of the county. The eastern boundary of the Greenville Plateau is of the same sort as the southeastern boundary of the Atlanta Plateau, an indefinite line marking the change from the nearly level surface of the Plateau to the sloping surface of the district called the Midland Slope. The position of this line is not definitely known, because there are no topographic maps of the area, but it coincides approximately with the position of the divide between Flint and Ocmulgee Rivers.

Except in the Pine Mountain district, which is so different that it almost deserves to be regarded as an independent division, the Greenville Plateau is a rather smooth upland area lying 800 to 900 feet above sea level in the part north of Pine Mountain. South of Pine Mountain the surface descends gradually to 700 feet or less at the southern margin of the district. Chattahoochee and Flint rivers flow southward across the district in valleys cut down 200 feet or more, and near these streams the upland surface is considerably dissected by the valleys of their tributaries, but elsewhere there are broad tracts of upland with little relief.

The rocks of the Greenville Plateau, like those of the rest of Midland Georgia, are in general similar to those of Piedmont Georgia, and the geologic structure is also very similar. Midland Georgia differs from Piedmont Georgia, however, in certain respects. Except in such areas as the Pine Mountain district, the individual sorts of rock generally occupy rather large areas and broad belts of country, instead of narrow strips and small lenticular areas. In these broad areas the structure, as a rule, is not so highly disordered, or at least so diverse, as elsewhere. This comparative uniformity of structure is reflected in the similarly rather uniform topography.

The Pine Mountain district, which is strikingly different from the rest of the Greenville Plateau in most respects, extends completely across the part of the Plateau in Georgia, and thus furnishes a basis for subdividing the Plateau for convenience in description.

The northern subdivision of the Greenville Plateau, including somewhat more than half of its area in Georgia, is a smooth and nearly level upland whose surface stands 800 to 900 feet above sea level. Here and there are patches of rougher country rising a little above the general surface, but there appears to be no true monadnock,unless a small ridge in the northwest corner of Harris County, just southeast of West Point, could be so classed. The surface is occupied largely by alternate broad belts of harder and softer rock, trending southwestward, and the main streams traverse the belts of softer rock, the divides being formed by the harder belts. There is thus a difference of 100 to 250 feet in altitude between the divides and the valley bottoms. As the streams approach the two main rivers that flow southward across the district, the valleys are somewhat deeper, but nowhere is the upland so deeply and sharply dissected as is the margin of the Dahlonega Plateau, for example, and there is very little really rough country.

Because of these favorable conditions, this part of the district is largely cleared and settled, being part of the belt of greatest density of population in the State. The population is also rather evenly distributed, there being many small towns and villages, but LaGrange and Griffin are the only important cities. Railroads find easy routes across the smooth upland and the district is crossed by several lines reaching nearly all parts of it.

The southern subdivision of the Greenville Plateau, including about two-fifths of the area of the Plateau in Georgia, lies south of the Pine Mountain district, between it and the margin of the Coastal Plain. It is in most respects similar to the northern subdivision, just described, but differs from that subdivision in some important particulars. East of Flint River its upland surface lies nearly everywhere a little more than 700 feet above sea level, but is rather deeply and sharply trenched by the valleys of Flint River and other streams flowing southeastward to the Coastal Plain. In this part, too, the margin of the Coastal Plain lies far up on the upland, but the valleys have been cut down through the sedimentary rocks, so that the crystalline rocks of the Central Upland extend several miles down the valleys. There is, therefore, no well-defined topographic break between the two provinces.

West of Flint River the conditions are different. The upland surface slopes gently southward from an altitude of nearly 800 feet at the base of Pine and Oak mountains to about 700 feet in eastern Talbot County and to less than 600 feet in southwestern Harris County. Although a few areas of Coastal Plain rocks are preserved on the margin of the upland, they have been stripped from most of it, and along this stretch the upland is bordered by a low but distinct escarpment facing southward. This escarpment is less than 100 feet high and scarcely perceptible in eastern Talbot County, but its base descends westward toward the Chattahoochee and northeast of Columbus there is a marked descent of 300 feet or more from the rim of the upland to the margin of the Coastal Plain.

This subdivision of the Greenville Plateau is not so much cleared and settled as the northern subdivision, and there are relatively few towns. The most important places are Thomaston, East Thomaston and Talbotton. The eastern part of the division, in particular, is so sparsely settled that for miles along some main roads there are no villages larger than cross-roads hamlets. Columbus, the fifth city of the State, although situated chiefly in the Coastal Plain, is just at the southwest corner of the Greenville Plateau and partly within it. There is a dense suburban population in the part of the district adjacent to Columbus, and several railroads radiating from that city traverse parts of the district. Barnesville, the county seat of Lamar County, is situated at the eastern margin of the Greenville Plateau, at the point where the three divisions of the Plateau adjoin, hence it can hardly be said to be in any one of them, but rather to be in all three.

The third subdivision of the Greenville Plateau, the Pine Mountain district, differs so greatly from the rest of the Plateau that it might well be regarded as an independent division. In Georgia it completely divides the Greenville Plateau into two parts, but it does not continue, as a distinct subdivision, into Alabama, where the westward extension of the Greenville Plateau is continuous from its northwestern margin southward to the border of the Coastal Plain.

The Pine Mountain district is a roughly lenticular area, 65 miles long and 10 miles wide at its middle. It begins on the west at the end of Pine Mountain, on the east bank of Chattahoochee River about 18 miles north of Columbus, and extends east-northeastward to Barnesville, where it appears to die out. The district is characterized by bold, rough, and steep-sided, though not very high, linear ridges, locally called mountains, and they well deserve the name, for they are mountainous in every respect except their size. At the eastern and western ends of the district there is but a single ridge, which is almost continuous throughout its length and which is called Pine Mountain. A line of interrupted short ridges, standing a few miles south of Pine Mountain and known throughout as Oak Mountain, begins on the west at Hamilton, in Harris County, and extends northeastward to the southeast corner of Pike County.

At its ends Pine Mountain is a rather small and narrow ridge, only 150 to 200 feet above the upland. In its middle portion, in southern Meriwether and northwestern Upson counties, it is extremely irregular and sinuous and stands at some places about 400 feet above the upland. Just southwest of Warm Springs it is about 3 miles wide at its base, and has a broad flat summit standing between 1,200 and 1,300 feet above sea level. Southeast of Woodbury, where it is crossed by Flint River, the range is looped in such complicated fashion that the river, which is there fairly straight, has cut three gorges through it in 6 miles. These gorges are more than 400 feet deep and very narrow, with nearly precipitous walls, and the scenery of this part of the range, as, in fact of nearly all of it, is extremely picturesque. Hence, the district has attained some popularity as a summer resort, especially

at Warm Springs, in Meriwether County. The topographic character of this part of the district is shown on pl. XXIV.

The series of disconnected knobs and short ridges that make up what is called Oak Mountain is not so sinuous as Pine Mountain and the ridges are not so high or broad. In some places their summits stand 300 feet or more above the upland, but most of Oak Mountain is rather low and in some stretches it rises scarcely at all above the surrounding country. It also has its picturesque scenery, however, especially where it is crossed by a line of the Southern Railway in eastern Harris County. In this part of the district the two ranges are 3 to 5 miles apart and the broad vale between them is essentially part of the general upland of the Greenville Plateau and does not greatly differ from other parts of that upland.

The mountain ridges of the Pine Mountain district owe their existence and form to belts and lenses of coarsely granular quartzite that is highly resistant to erosion, much more so than the sorts of rock that form the surrounding upland. The whole mass of the mountains is not formed of quartzite, but it is in sufficient quantity and in sufficiently thick beds so that it makes a very resistant formation. Furthermore, although it breaks down rather rapidly when weathered and forms a mass of rubble consisting of pebbles and cobbles from the size of a pea up to small boulders, it is very slightly soluble, hence the sheet of rubble, which covers the mountain slopes from top to base, acts as a protecting blanket and has had much to do with preserving the height and boldness of the ridges.

The belt of rocks that forms the Pine Mountain ridges extends into Alabama, but in that State the quartzite is in rather thin layers interbedded with much less resistant rocks. Hence it does not form bold ridges, as in Georgia, but occupies belts of rough ground rising only a little above the upland.

The Pine Mountain district is so rough and the soil is so stony that it is but sparsely settled and remains largely in woodland. The only important town is Manchester, in Meriwether County, which is a railroad junction and has some manufacturing. Warm Springs has considerable repute as a summer resort, and summer homes are situated here and there throughout the district.

THE MIDLAND SLOPE

The district here called the Midland Slope includes a belt of territory, 20 to 30 miles wide and nearly 150 miles long, in the central and northern portions of Midland Georgia. It is not straight, but makes a bend of nearly a right angle at South River. From Savannah River it extends southwestward, with a width of 30 miles, to South River, whench it extends south-southeastward, just west of Ocmulgee River, with a width of 20 miles, to the border of the Coastal Plain. This part of the district nearly coincides in extent with the part of the drainage basin of Ocmulgee River lying west of that river. The general character of the district is sufficiently indicated by its name. It is a broadly sloping belt across Midland Georgia by which the gen-

Part of the Talbotton sheet

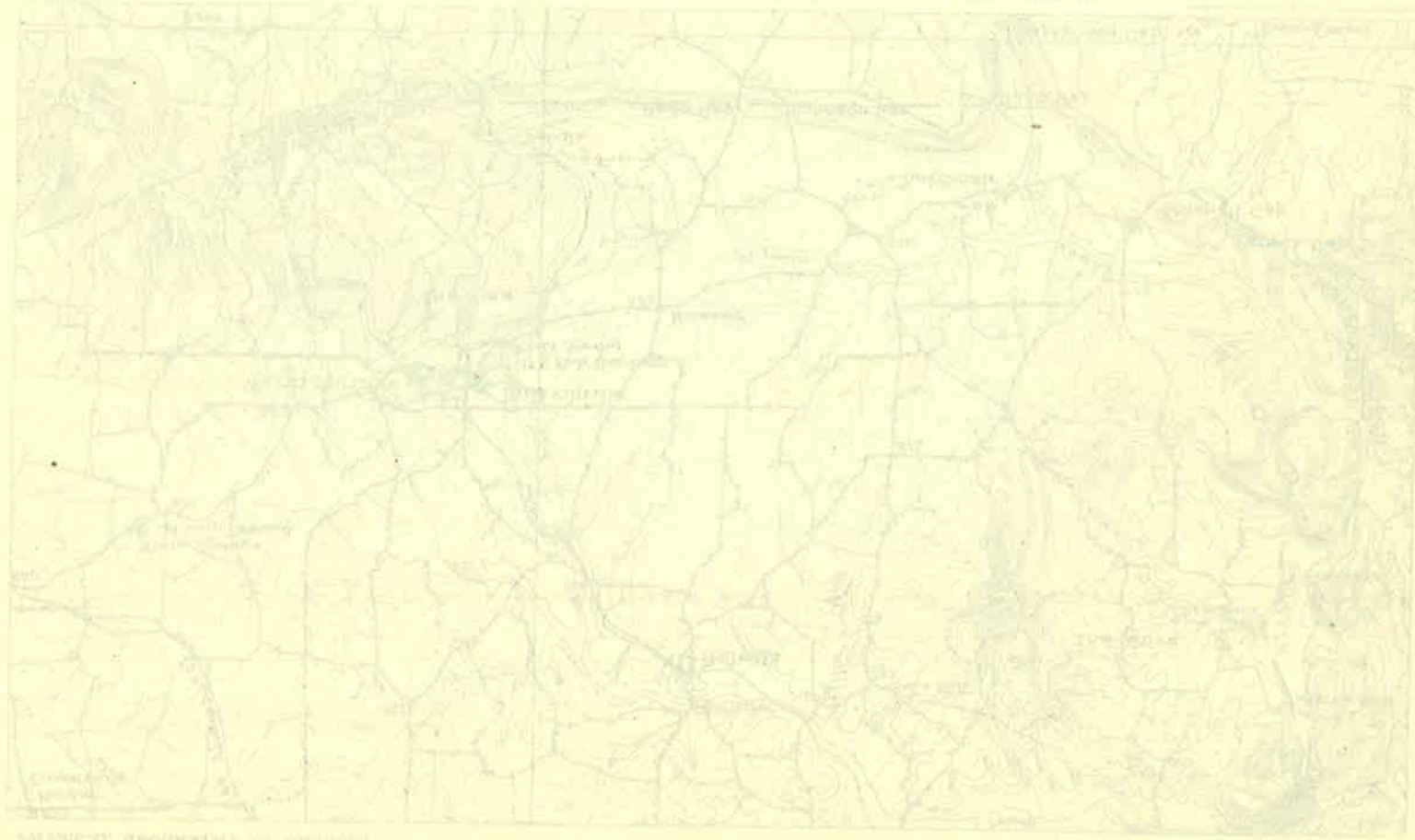
PINE MOUNTAIN AND THE GREENVILLE PLATEAU NEAR WARM SPRINGS

Scale 125,000

0 1 2 3 4 5 6 Miles

Contour interval 50 feet

Datum is mean sea level



eral level of the surface decreases from that of the higher Greenville and Atlanta plateaus on the west and northwest to that of the lower Washington Plateau on the east and southeast.

The district is bounded on the northwest and southeast by the others just mentioned and at its southern end by the Coastal Plain, and it extends northeastward into South Carolina. Because of its nature its boundaries are indefinite and not easily determined. Those on the west and northwest have been discussed in the descriptions of the Greenville and Atlanta plateaus. That on the east and southeast is a similarly indefinite line between the sloping surface of the district and the nearly level upland of the Washington Plateau. The southern boundary is defined by the margin of the Coastal Plain. Only along the part of the northwestern boundary where the district adjoins the Dahlonega Plateau is the line, which there lies along the base of the escarpment, fairly well defined. Only part of the area included in the district has been topographically mapped and on most of the maps the contour interval is too large for close determination of the position and slope of the upland surface. None of the part of the district lying west of Ocmulgee River has been so mapped and knowledge of its surface form is meager.

The rocks and structure of the Midland Slope are nearly the same as those of the rest of Midland Georgia, aside from the Pine Mountain district. Its mode of development and the effect of the rocks and structure on the surface form are in general similar to those elsewhere in the section, but differ somewhat in detail because of the attitude of the surface. The district may, for convenience, be regarded as divided by South River into two parts.

As has been stated, the western part of the district nearly coincides in extent with that part of the drainage basin of Ocmulgee River, in Midland Georgia, lying west of the river. Considered broadly, it is the slope by which the surface descends from the divide on the west to the upland level near the river. The altitude of the upland along the divide decreases gradually from about 1,000 feet above sea level near Jonesboro, in Clayton County, to about 700 feet near Knoxville, in Crawford County, at the margin of the Coastal Plain, and the surface descends eastward 250 to 300 feet from the divide to the margin of the river trench. The area, as a whole, is rather smoothly sloping, without marked topographic features, other than the valleys of the tributary streams. These valleys are deeper and wider near South River, hence that part of the area has more relief than the part near the divide.

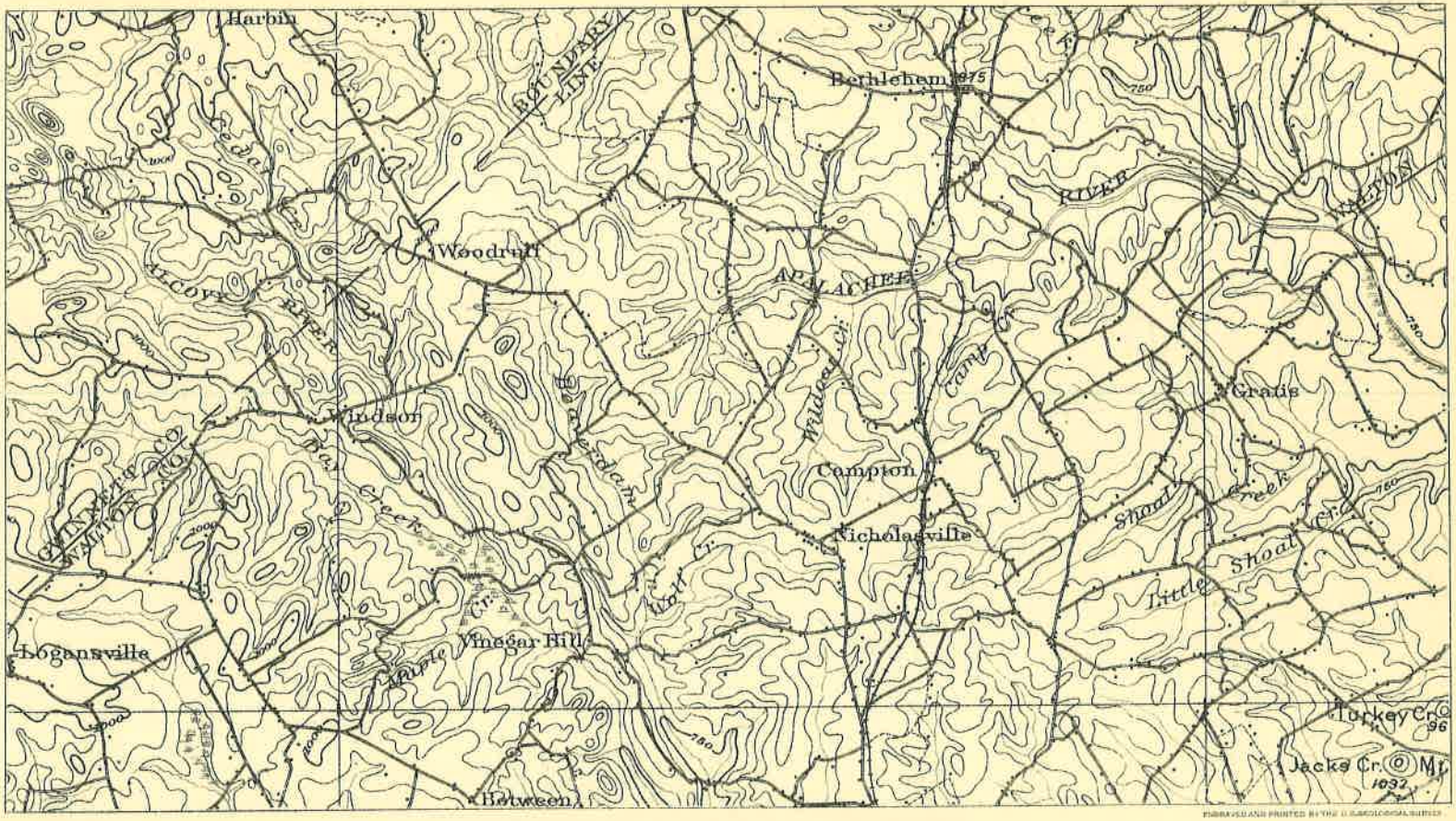
Situated as it is, on the routes from Atlanta to Macon, which is just at the southeastern corner of the area, the belt is traversed by two railroads and by the main highway joining the two large cities. The principal cities, in addition to Macon, are Forsyth, Jackson, McDonough, and Jonesboro. Griffin and Barnesville are just outside the district, on the eastern margin of the Greenville Plateau. The western and more level part of the area is generally cleared and settled, but the eastern part, near Ocmulgee River, where the surface is much rougher, is less settled.

The eastern part of the district, lying between South and Savannah rivers, is a similar broadly sloping belt by which the surface descends from the southeastern margin of the Atlanta Plateau and from the base of the escarpment bounding the Dahlonega Plateau to the nearly level upland of the Washington Plateau. The altitude of the northwestern margin of the district is 1,000 to 1,100 feet, and that of the southeastern margin is 750 to 800 feet.

This sloping belt is rather strongly furrowed by the valleys of the many small streams that flow southeastward across it to be gathered finally in the trunk streams of Ocmulgee, Oconee, and Savannah rivers, but otherwise it is fairly smooth. Only a few small residual mountains, really only bold, steep-sided hills, stand above it. The most conspicuous of these are a half-dozen such knobs scattered along a northeast-southwest line extending from west of Covington, in Newton County, to some distance east of Monroe, in Walton County. The best known of these knobs is Alcovy Mountain, south of Monroe, whose summit stands 1,108 feet above sea level and 360 feet above the flood plain of the Alcovy River. The mountain, which is a small knob of quartzite, rises almost directly from the bank of the river, an almost unique situation for a monadnock standing above a base-leveled plain. The topographic character of this part of the district is shown on pl. XXV.

In the northeastern part of the district, a few miles southwest of Toccoa, is Currahee Mountain, whose summit stands more than 1,700 feet above sea level and overlooks all the Chattahoochee Ridge except Griffin Mountain. Currahee Mountain is so close to the base of the escarpment that it might almost be regarded as an outlier of the Ridge, but it is completely separated from the Ridge and surrounded by upland, so it is best considered as a monadnock on the Midland Slope.

Although much of the rougher portion of the area is only partly cleared and is sparsely settled, this division of the district is, on the whole, the most densely settled part of Georgia, because it contains more small cities and large towns than any other area of comparable size. This is due to a combination of favorable circumstances, such as fairly good soils, healthful climate, and situation on or near the main routes of travel eastward from Atlanta. Chiefly, however, it seems to be due to the fact that this is the principal water-power district of the State and hence, taken by and large, the principal manufacturing district. It contains no such large manufacturing cities as Macon and Columbus, but it does contain a number of smaller cities and towns, such as Athens, Covington, Oxford, Porterdale, Monroe, Social Circle, Lawrenceville, Winder, Jefferson, Commerce, Canon and Toccoa, to mention only a few of the principal ones. Water-power for manufacturing is developed at a larger number of places in this section than elsewhere because of its situation on a slope, where the streams have steeper grades and more rapid currents than in the parts of their courses lower down, where the streams have less steep grades across the more nearly level Washington Plateau.



Part of the Monroe sheet

THE MIDLAND SLOPE EAST OF LOGANSVILLE

Scale $\frac{1}{125,000}$

0 1 2 3 4 5 6 Miles

Contour interval 50 feet

Datum is mean sea level

THE WASHINGTON PLATEAU

The district comprising the eastern and southeastern portions of Midland Georgia is named the Washington Plateau from Washington, in Wilkes County, near which place the character of the Plateau is well displayed. It is bordered on the west and northwest by the Midland Slope and on the southeast by the Coastal Plain and probably extends northeastward into South Carolina, but information on this point is lacking. The boundary on the west and northwest has already been described. Its exact position, as has been said, cannot be determined, but it crosses Midland Georgia from Savannah to Ocmulgee Rivers a little southeast of Hartwell, Athens, Social Circle, and Covington, and reaches Ocmulgee River at about the point where that stream is formed by the junction of South, Yellow and Alcovy rivers. Thence it follows the course of the Ocmulgee to Macon.

The southeastern boundary is an extremely sinuous and somewhat indefinite line at the inner or northwestern limit of the sedimentary rocks of the Coastal Plain. In eastern Georgia this line is not marked, except in a very few places, by any striking difference in the topography of the areas separated by it. On the main divide the upland surface extends continuously from one province to the other and the main valleys are cut down to about the same depth in both provinces, without a marked change in grade at or near the line. In some places detailed study of the topography shows that the surface of the Central Upland is somewhat more closely dissected by rain-gullies and small ravines than is that of the Coastal Plain, and most of the larger valleys that are cut mainly in Coastal Plain rocks have wider bottoms and more flaring sides than those in the Central Upland. If carefully drawn, the boundary between the two provinces probably should follow most of the sinuosities of the margin of the Coastal Plain sediments, hence it can be represented accurately only on the largest scale maps and for most purposes must be greatly generalized.

The boundary between the Piedmont Upland and the Coastal Plain is often called the Fall Line, although the two are not strictly identical. The Fall Line is a line connecting the points, on the streams that flow from the Upland into the Coastal Plain, at which they leave the harder rocks of the Piedmont for the softer sediments of the Plain and at or close above which falls or rapids have been formed on nearly all the streams that cross the line. It is, therefore, really a succession of points and, if shown as a line, it should be drawn directly from the point where it is crossed by one stream to that where it is crossed by the next. The boundary of the Coastal Plain sediments, on the other hand, does not, in most places, cross the divide between two streams directly from the Fall Line on one stream to that on the next, but, as the sediments lap up on the divides and are cut away in the valleys, it is a sinuous line, looping up on each divide and back down each valley. In some parts of the Atlantic Slope, as in the stretch between Delaware and Rappahannock rivers, the two lines so nearly coincide on the divides as well as at the streams that little error is in-

volved in using the name Fall Line for both. Throughout this stretch, too, there is a marked descent, really an escarpment, from the upland of the Piedmont to the Coastal Plain. As the Fall Line is at the base of the escarpment, it may be spoken of as the province boundary without serious error.

In eastern Georgia the conditions are very different. There is no escarpment or other marked topographic distinction at the province boundary, which can be drawn only at the margin of the Coastal Plain sediments. As can be seen from the geologic map, plate II, such a line is very different from the true Fall Line, as the two coincide only where crossed by the streams and are miles apart on some of the divides. To avoid too great complexity in the province boundary on the maps in this book, it has been generalized so that it does not extend down all the valleys to the limit of the crystalline rocks and hence it does not, as drawn, coincide with the Fall Line, which is southeast of it, except at a few places.

Only a part of the Washington Plateau has been topographically mapped and very little is known in detail of the surface form of the rest of the district. In general, it is a nearly smooth upland whose surface descends gently and almost imperceptibly southeastward from about 800 feet above sea level at its northwestern margin to about 500 feet at its southeastern margin. It is of nearly the same topographic character throughout and no subdivisions have been distinguished in it The character of part of it is shown by pl. XXVI.

Not much is known of the rocks and the geologic structure of the Washington Plateau, but they appear to be in essential respects substantially the same as those of the Greenville Plateau, aside from the Pine Mountain district, and to have had about the same effect on the development of surface form. The mode of development of the surface of the district has been substantially the same as in the other parts of Midland Georgia.

Because of the lack of detailed knowledge of the surface form in much of the district only rather general statements can be made regarding it, but the general form is much the same throughout, and in such an area general statements give a fairly accurate idea of the appearance of the country, The upland surface is, as a whole, remarkably even. It is, of course, somewhat higher on the main divides and descends somewhat toward the main valleys, but such slopes are very gentle and scarcely perceptible in the landscape, which gives the impression of a nearly flat plain, trenched by the valleys of the numerous streams, large and small, that take a general southeasterly course across it to the Coastal Plain. In more than two-thirds of the area the altitude of the upland surface, as far as known, is between 650 and 800 feet, being greatest along the northwestern margin. Southeast of a line passing approximately through Gray, Sparta, and Warrenton the surface descends more rapidly to not much more than 500 feet above sea level at the margin of the Coastal Plain. It also descends eastward toward Savannah River to about the same altitude near the brink of the trench of the river.

THE WASHINGTON PLATEAU NEAR WASHINGTON

Scale $\frac{1}{125000}$

1 ½ 0 1 2 3 4 5 Miles

Contour interval 50 feet

Datum is mean sea level

Scarcely any residual knobs or ridges break the uniformity of the sky-line throughout the district. A low ridge of resistant rock in northwestern Jasper County, nearly in line with Pine Mountain and possibly a continuation of that range, though separated from it by nearly 30 miles, stands 100 feet or so above the upland surface. Far eastward, in Lincoln County, Graves Mountain, a small knob of quartzite containing great dikes of pegmatite, stands 900 feet above sea level and 350 feet above the surrounding upland, and is possibly the only true monadnock in eastern Georgia. Because of its isolation and the smoothness of the surrounding plateau, it is, although small, conspicuous for many miles from all directions. One or two smaller knobs, especially in eastern Columbia County, and a few irregular ridges of rougher ground stand a little above the general level, but the district, as a whole, is conspicuously free from such eminences.

In the northwestern part of the district and along the main divides throughout the upland the valleys are broad and sha'low, with long gentle side slopes. The valleys of even the main streams, except Savannah River, although deeper, are not sharply cut in this part of the district. Toward the southeastern margin of the district, however, especially along Ocmulgee and Oconee rivers, the streams have intrenched themselves more deeply and the main rivers flow in steep-walled valleys 200 to 300 feet deep, into which the tributaries descend through similarly deep and narrow side valleys. The southeastern margin of the district is, therefore, considerably and rather deeply dissected near the valleys of the main streams. Because of the gentle descent of the surface eastward toward Savannah River, the valley of which has been cut considerably lower than those of the other three main streams draining the district, the valleys of its tributaries do not become much deeper as they near the main stream. The eastern side of the district, therefore, is also rather completely dissected by valleys, though not deeply.

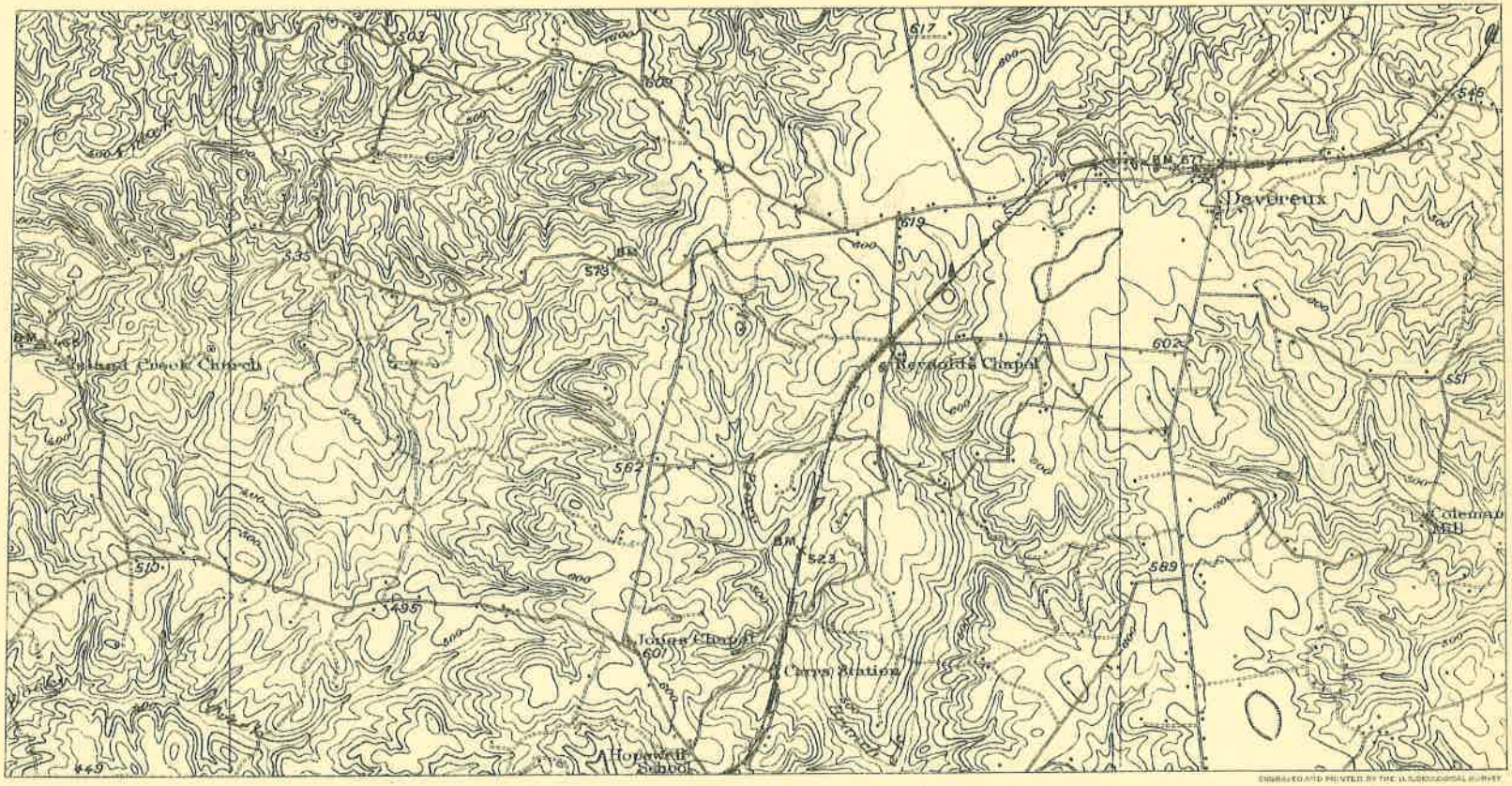
The surface of the upland on the main divides is very little dissected along the southeastern margin of the district and the upland surface continues on a uniform southeasterly slope from the crystalline rock surface of the Central Upland to the surface formed by the unconsolidated sediments of the Coastal Plain. In some places there is no break in the surface between the two provinces and the two sorts of rocks, and no marked topographic distinction in the form of the surface. Close examination of the surface and of good topographic maps reveals two minor differences which seem to be systematic. The surface of the Coastal Plain, in the region adjacent to the boundary between the two provinces, is as a rule smoother and less dissected by rain-gullies and small ravines than is that of the Central Upland. This is probably because the strata of the Coastal Plain lie nearly level and because, although formed of soft and unconsolidated material, they are protected by a covering of fine gravel and coarse sand which is strongly resistant to dissection by rills and rivulets, whereas the surface of the Central Upland is covered with a thick

layer of disintegrated rock waste and residual clay, which is rather rapidly removed by running water.

The other minor difference in the surface form is due to the fact that the structure of the rocks of the Central Upland is not uniform and that there are some layers and lenses of considerably more or considerably less resistance to erosion than the average. Such bodies of rock tend to divert or to guide, as the case may be, the courses of the smaller streams, as well as to cause minor differences in the surface form. In some places along the border of the two provinces the part of the upland developed on the crystalline rocks can be distinguished from that developed on the Coastal Plain by such minor characters. Some of these differences are illustrated in pl. XVII.

The northwestern part of the Washington Plateau, adjacent to the Midland Slope, shares with that district the distinction of being one of the most densely settled portions of Georgia, and this part of the district is rather generally cleared and contains a considerable number of small cities and large towns, though there are no large cities. The principal places are Elberton, Washington, Eatonton, Madison, Hartwell, Greensboro, Monticello, and Comer. The eastern and southeastern portions of the district, where the surface is somewhat rougher, when the soil conditions appear to be somewhat less favorable, and when communication is more difficult, are less cleared and less densely settled, except along and near the railroad connecting Augusta and Atlanta. Considerable lumbering has developed in this part of the district in recent years and some of the smaller towns are growing rapidly. The principal places in this part of the district are Thomson, Sparta, Union Point and Warrenton. Macon and Augusta, two of the chief cities of the State, are situated at the southwestern and southeastern corners, respectively, of the district, and Milledgeville, another important city, is situated at its southern margin. All three cities are on the Fall Line and Macon and Augusta are as much cities of the Coastal Plain as of the Central Upland. They owe their importance to their situations with respect to the whole surrounding territory and are not primarily related to the Washington Plateau by itself.

The Washington Plateau is crossed by several railroads connecting Augusta, Milledgeville, and Macon, on one hand, with Atlanta, Athens and Elberton on the other hand, and intersecting at several points so that the district is rather well supplied with transportation facilities. It is, also, crossed by several main highways extending from Atlanta and Macon into the eastern part of the State and on into South Carolina.



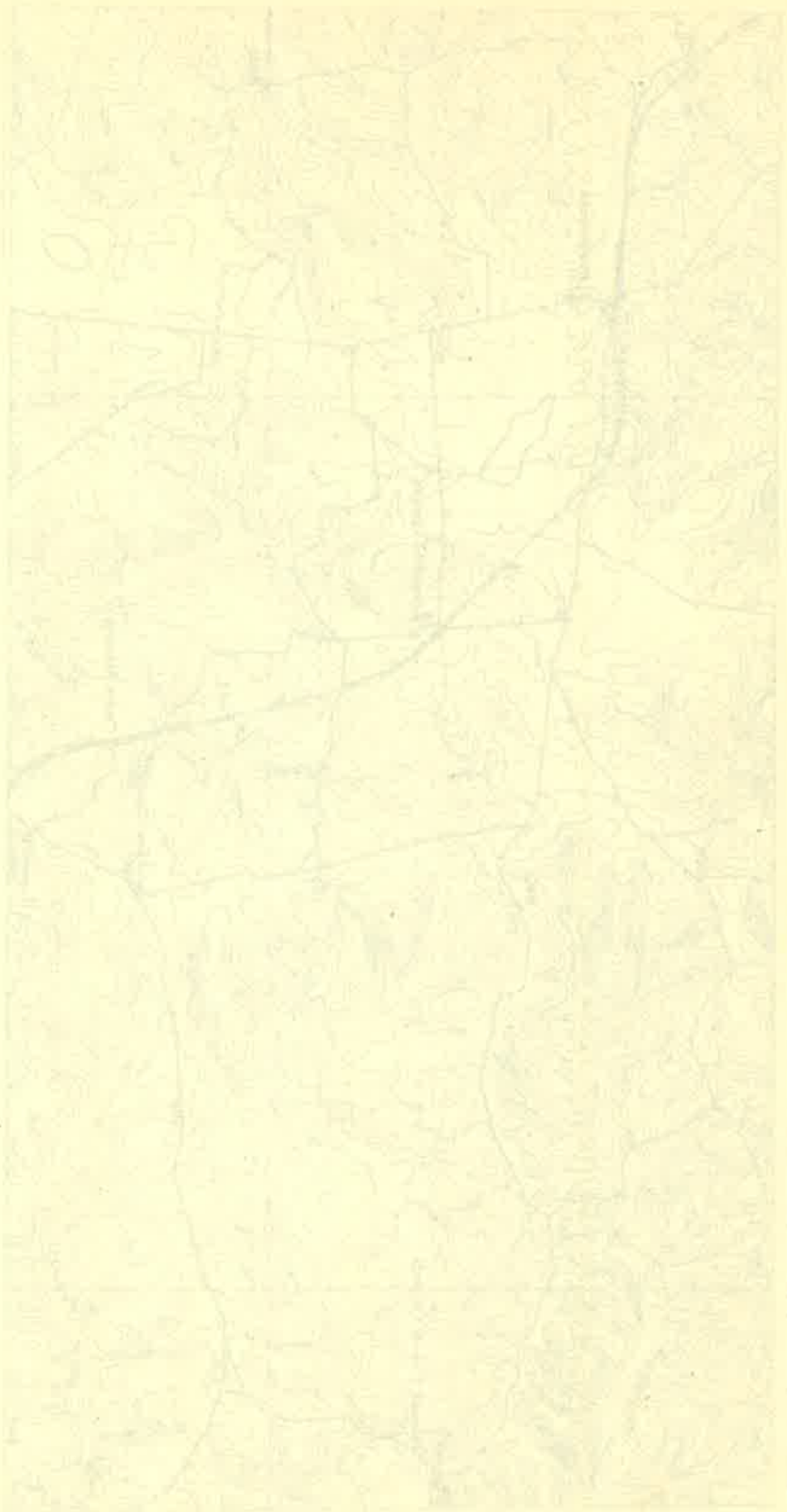
Part of the
Milledgeville sheet

THE COASTAL PLAIN AND THE CENTRAL UPLAND NEAR DEVEREUX

Scale $\frac{1}{62500}$

1 ½ 0 1 2 Miles

Contour interval 20 feet
Datum is mean sea level



DEVELOPMENT OF THE SURFACE

The development of the present surface of the Central Upland has been almost entirely through the process known to the students of earth forms as degradation, in other words, through the slow wearing down of the land surface, mainly by the action of running water. It has already been pointed out that the surface of the earth is undergoing constant change and that it has not always appeared as it does now. The study of land forms and their development has reached the stage where it is possible to make out much of the past history of the surface of a region from its present form and the relation of that form to the drainage pattern, the geologic structure, and the character of the neighboring regions. It is even possible to learn something of the form of the surface at an earlier time, when the development of the present surface began. That earlier surface may not have been the original one but it was at least the initial surface from which the present one was developed by the processes presumably still in operation.

A study of the rocks and geologic structure of the region, including the determination of their geologic age, throws light on the probable position and form of the surface when the processes that have taken part in the development of the present surface began to operate. Such things are part of the geologic history of the region and do not properly come within the scope of a book of this sort except in so far as they throw light on the origin of the present surface form. The origin of the rocks, the processes by which they were formed and deformed, and the series of events through which they reached their present position are unimportant of themselves for the present purpose and need not be discussed here. They are important, however, for the light they may throw on the original form of the surface and the effect of that form on subsequent events. They also tell something of the movements of the earth's crust during the development of the surface.

A part of the rocks of the Central Upland are made up of material derived from the breaking up of still older rocks, and deposited as nearly level layers of sediment in standing or running water. Some of them were evidently laid down on what was then the sea bottom, but they are now found up to 2,000 feet above the present sea level and there is reason to believe that they once extended much higher, before the surface was worn down to its present form. They are now folded and contorted and are nearly everywhere inclined at a considerable angle, and they now consist almost wholly of crystalline minerals, though their nature and texture show that they could not originally have been formed of such material. Geologists believe that the present position and condition of these bedded rocks are evidence that, since their deposition, they have suffered intense deformation. In other words, the part of the earth's crust in which they are found has been strongly compressed and greatly raised. Such deformation of the crust must necessarily have affected the form of the surface.

There is other evidence as well. Intermingled with the bedded rocks are many large and small masses of rocks of another sort which were not laid down as beds, but were solidified by cooling from a molten condition. While still fluid they melted their way amongst the other rocks or were forced between those rocks by pressure from beneath, and then solidified. As a large part of the present surface of the Central Upland is occupied by rocks of this sort, there must have been a great deal of such molten material intruded, as it is called, into the bedded rocks. Geologists believe, from the composition and structure of these rocks, and from their relation to the rocks of other kinds surrounding them, that they solidified at a considerable depth below the surface at the time when they were formed. The fact that they are now exposed on the surface, therefore, indicates that there has been a great amount of rock material removed which formerly covered them, yet they are now found more than 3,000 feet above sea level. Hence their character and present position also lead to the conclusion that, since their formation, there has been a great uplift and defomation of the earth's crust in the region.

Furthermore, the geologic relation of the Central Upland to adjacent regions also helps to explain the development of the present form of the Upland. The province is bounded on the northwest by the Valley, where all the rocks are of the bedded sort, laid down in nearly level layers on the sea bottom. There is evidence that the land from which the material forming the beds was derived lay southeast of the area where they were deposited and in the general position of the present Central Upland. Somewhere between the two regions there must have been a shore whose position would be shown, if nothing had happened since, by the margin of the beds deposited in the sea. There is no indication of a shore along the present boundary between the two regions and this is regarded as evidence that a great amount of material, including the former southeastward extension of the beds to the old shore, has been removed from the Central Upland during the formation of the surface.

On the southeast, along the border of the Coastal Plain, there is similar evidence. The rocks of the Coastal Plain are also beds of material derived from the waste of older rocks and laid down on the sea floor. The present northwestern margin of these beds lies on the surface of the rocks of the Central Upland at 500 to 700 feet above sea level and in few, if any, places is there any indication of a former shore along the present boundary. This indicates that, since the deposition of the beds of the Coastal Plain, there has been uplift of the land and removal of the former shoreward margin of the beds.

As already stated, all these things are part of the geology of the region and are not immediately connected with the development of the surface of the Central Upland. They are important, however, as evidence of the original conditions and as furnishing a starting point for the story of the surface development. Through the study of such geologic data students of land forms lay the foundation for their study of the development of form by obtaining some idea of

the raw material, as it were, from which the present surface has been developed.

The geologic evidence, therefore, indicates that, at the remote period when the long series of events began that have led to the development of the present form of the Central Upland, the general region now occupied by the province was a mountainous country of considerable altitude. The available evidence also indicates that throughout the development of the surface the dominant process has been that known as degradation, that is, the lowering of the surface through the removal of material by various natural agents, mainly, in this part of the world, running water. Possibly part of the surface adjacent to the present Coastal Plain may sometimes have also undergone degradation through attack by the sea, but this is not certain.

Although the chief agent of degradation in such a region as central Georgia is flowing surface water, it is generally aided by the preparation of material for removal through breaking up of the solid rocks by the work of the various natural agents grouped under the general head of weathering. This may not have always been so in the past, but it is strikingly so at the present time. The softening and breaking up of the hard rocks by weathering has proceeded to a depth of many feet over a considerable part of the Upland and the removal by flowing water of the material composing the surface has thus been greatly facilitated. The views shown in plate III and in plate XVIII-A and B, illustrate some of the ways in which hard rocks are broken up by disintegration, by solution, and by the penetration of water along joints and cleavage cracks, thus facilitating weathering.

On a surface of strong relief and considerable altitude, such as the region now the Central Upland must have had, the first effect of flowing water in modifying surface form is to deepen the valleys and steepen the bordering slopes and in general to increase and sharpen the relief. As time goes on the valley floors are widened, the slopes recede and become less steep, and the divides are lowered. Thus, though degradation is at first confined to the stream channels and steeper slopes, it eventually attacks the higher parts of the surface and from that time on its effect is to diminish the relief and lower the surface as a whole. If the process is continued long enough the valley floors are widened and coalesce in their down-stream portions, steep slopes disappear, divides are lowered to gentle swells and the whole region is reduced to a rolling country, no part of which is much above the grades of the streams. Such a surface, almost a plain, produced in such a manner, is called a **peneplain.** No part of the surface can be reduced below the lowest grade to which the master stream draining the area can cut its channel and the lowest point on this grade is called the **base-level** of the region. Hence a peneplain is sometimes spoken of as a base-leveled surface. In some parts of the region some areas on divides and, therefore, remote from main drainage lines, may remain unreduced and standing above the surrounding territory. Other areas may remain unreduced because formed of rocks so much more resistant than those surrounding them that they

are not worn down so rapidly and hence remain as residual knobs and ridges. Such residual hills and mountains, standing above a peneplain, are called **monadnocks.**

Only rarely is degradation continued uninterruptedly to the stage where a considerable region is almost wholly reduced to a peneplain. As a rule it is interrupted by some earth movement that affects the process or its results, a new cycle is started, and the development of surface form is begun afresh. Such an interruption may occur at any stage in the development of a base-leveled surface and the general form developed at the time when it occurs may range anywhere from a mountainous area in which degradation has hardly more than begun to an almost completely base-leveled surface.

Sometimes the interruption is a subsidence or tilting of the surface that carries it beneath the sea, where it receives a cover of deposits, and the further development of the old surface is indefinitely suspended. Sometimes it is an elevation or tilting that raises it with regard to base-level, so that the process of degradation is quickened, and perhaps brings some new surface above sea level where it is exposed to degradation. If the activity of the streams is renewed the relief is again increased for a time, but when the stage of maturity, as it is called, is passed in the new cycle, the general lowering of the surface to form a peneplain is begun again. The surface of the new peneplain will lie lower than that of the one whose formation was interrupted, because the base-level is now lower. If, as generally happens, the new cycle is in turn interrupted before the whole region is reduced, portions of the older peneplain surface will remain as residual areas surrounded or bordered by the lower country that has been reduced to the newer one.

In the description of the surface form of the Central Upland it was stated that the Upland is not a single plateau, but comprises several plateaus or platforms lying at different altitudes and separated by distinct slopes or even by escarpments. Furthermore, there are many knobs and even fairly large mountains that stand well above the general level and do not appear ever to have been reduced to a base-leveled surface or even approximately so. That the region as a whole has been so reduced, one or more times, is evident from several facts. The surface is smooth and almost level over great areas that are occupied by rocks that have been much deformed. The conclusion is inescapable that such a surface, truncating the folded and highly inclined layers of rock, has been formed by some sort of planation. Many of the streams flow directly across the trend of the geologic structure with no regard to the relative hardness of the layers of the different sorts of rock whose edges they cross. They could have acquired such courses only on a surface so smooth that the inequalities of relief due to differences in the hardness of the rocks had been obliterated. In parts of their courses, some streams, notably Etowah and Coosawattee rivers, flow in the peculiar loops called meanders, but at the bottoms of deep trenches that have the same meandering courses as the streams. This can be explained only on the assumption

that the streams acquired the meandering courses when flowing on former flood plains, all traces of which have since been destroyed in the cutting of the trenches following a later uplift of the surface.

The general course of events in the carving of the surface of the Central Upland, as far as it has been made out by applying the principles of interpretation briefly outlined above, is as follows. At some past time, since the great movement of the earth's crust in the southern Appalachian region that resulted in the folding and squeezing of the rocks and the elevation of the surface to mountainous heights and relief, there was a long cycle of seemingly uninterrupted degradation of the surface of the region now including the Central Upland. This cycle may have been preceded by others of which there is no record preserved, but during it reduction of the surface proceeded so far that practically all the area of the Central Upland was reduced to a peneplain or generally base-leveled surface. This peneplain probably also extended over a considerable part of the area now the Appalachian Valley and part or all of that now covered by the Coastal Plain. Only a few monadnocks stood above the general surface in the northern part, adjacent to the region that was still mountainous and that now forms the Highland. Remnants of this peneplain are preserved in the surface of the Dahlonega Plateau, which is clearly part of an old planated, or nearly base-leveled, surface.

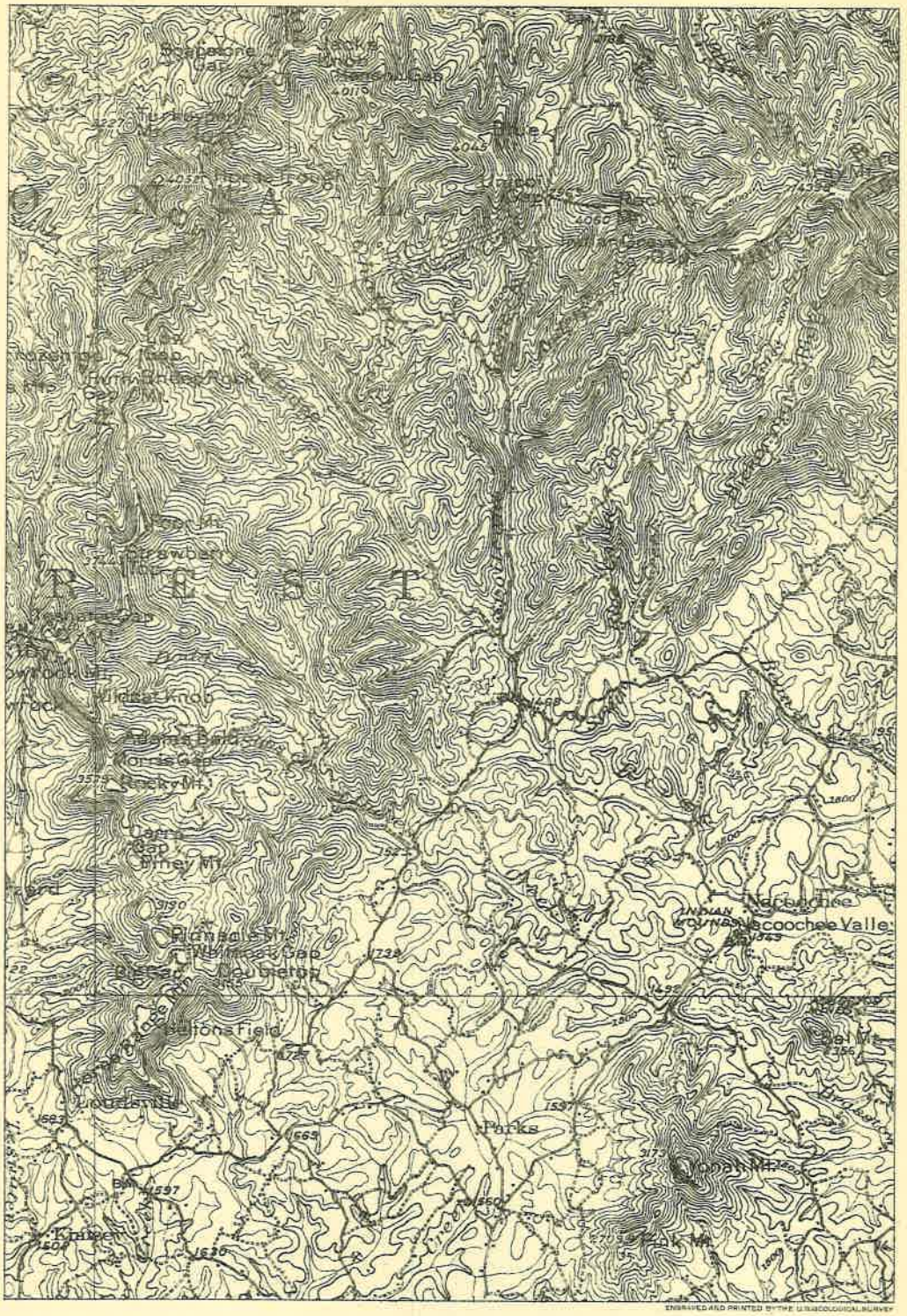
The formation of this peneplain was eventually terminated, as all such cycles are, by some sort of crustal movement. The area in which its remnants are now preserved was uplifted a few hundred feet and renewed degradation began the carving of a second peneplain, now preserved in the Gainesville platform of the Atlanta Plateau. Before this had been developed over so great an area, as the older one another movement of the crust brought its formation to an end and inaugurated a new cycle, in which a third surface was developed, now represented by the Fairburn Platform of the Atlanta Plateau. Its formation was in turn interrupted and at least one, if not two, younger peneplains were subsequently developed over parts of the area now comprised in Midland Georgia. Each cycle seems to have been shorter than its predecessor, or else the rate of degradation became progressively slower, as each peneplain in turn was developed over a smaller area than the one preceding it. If this were not the case the older ones would have been completely removed by later degradation and no evidence of their existence would have been preserved in old base-leveled surfaces. In the later cycles, especially in the one during which the Washington Plateau was formed, the planation was almost complete throughout the area over which the surface was developed, for there are only one or two small monadnocks standing above its surface.

The movements of the crust that closed each cycle in turn were of the sort that affect broad areas without marked deformation of the surface and the underlying rocks. Nevertheless, it is not likely that they consisted of vertical movements alone. More probably each was accompanied by some tilting and warping of different parts

of the surface, which, therefore, was not everywhere uplifted to the same altitude and which was even depressed in some parts. At times some parts of the surface now adjacent to or within the area now occupied by the Coastal Plain were depressed below sea level and covered with marine sediments. Later they were, again, uplifted and the newly deposited beds were brought above sea level. That the rocks of the Coastal Plain formerly extended farther northwest than now and covered a part of the present Central Upland is certain, but no definite evidence is yet available on the extent of this former overlap. After the re-elevation the beds at the margin of the Coastal Plain were stripped from a part of the surface of the crystalline rocks by degradation in the next cycle and thus evidence of the position of the former shore was removed.

Probably, as a rule, the elevation of the part of the surface near the mountains and the depression of the part near the coast occurred at or about the same time, and, if so, the surface of the intermediate belt of country must have been given a tilt seaward. It is probable that the present slope of the surface of the district called the Midland slope originated in such a manner. The tilting also increased the power of the streams and caused them to deepen their valleys and steepen the slide slopes. Since the last great movement that affected the region, as a whole, the streams have, during the present cycle, cut their valleys to depths of 100 to 400 feet below the upland surface. The headwaters of the streams that flow southeastward directly to the Atlantic have also been engaged in shifting the divide at their heads to the northwest, at the expense of the tributaries to the Chattahoochee from the southeast.

At the beginning of the Quaternary period of geologic time, the period in which we are now living, the seaward margin of the State had been depressed a few hundred feet and about half the area of the Coastal Plain within the State was covered by the sea for a short time. Since then the depressed area has risen to its present position, not continuously, but in several small uplifts separated by intervals of quiescence. During this time the marine terraces of the Coastal Plain and the associated river terraces which are discussed in the description of the Coastal Plain, were formed. The effects of the submergence of the several small uplifts during the re-emergence were felt in the valleys of the main rivers to points far above the Fall Line and some of the river terraces extend up the main valleys into the Central Upland. On account of the lack of large-scale topographic maps and detailed field study little is known of the river terraces in the Central Upland beyond the fact of their existence. As they are directly continuous with the river terraces of the Coastal Plain the explanation of those terraces given in the description of the Coastal Plain holds for them also.



THE DAHLONEGA PLATEAU NEAR MT. YONAH AND THE HIGHLAND NEAR UNICOI GAP

Scale $\frac{1}{125000}$

1 0 1 2 3 4 5 Miles

Part of the Dahlonega sheet

Contour interval 100 feet

Datum is mean sea level

THE HIGHLAND

By Arthur Keith

LOCATION AND BOUNDARIES

The Georgia Highland is situated in the northeast corner of Georgia. It is a part of the much greater mass of the Appalachian Mountains. The Highland enters the State from North Carolina and Tennessee, where it forms the largest and highest mass of the Mountains. Beginning in the corner of the State it has a breadth of 92 miles east and west along the State boundary, and its southwest end is 48 miles south of the boundary; its area is about 1,850 square miles.

The northern boundary of the State runs almost east and west and is just south of the 35th degree of latitude; this is not in the slightest way a natural boundary of the Highland. Its west boundary runs roughly north and south at the foot of the Mountains, where they spring sharply up from the flat Appalachian Valley. The southeast boundary is formed by a similar rise of the Mountains from the Dahlonega Plateau of the Piedmont Upland, except for a few miles at its northeast end, where it is formed by Chattooga River. The general course of the boundary is from northeast to southwest, but at each of the larger streams the Plateau indents it from 2 to 4 miles into the general outline of the Highland. The southwest end of the Highland is far more irregular and is split open by three arms of the Plateau. The valley of the central of these arms can be followed entirely through the mountains in a northeast course, although in two places it is barely one-half mile in width. These three arms of the Plateau follow branches of Coosawattee River, which has a general westward flow into Tennessee River. The southeastern and southwestern boundaries of the Highland follow natural features and can be readily distinguished upon the ground. The separation of the Mountains from the Piedmont Upland and the Appalachian Valley is quite as plain from a distance as it is near at hand, and the mountain mass is a very obvious unit high above the Piedmont and the Valley, as is seen in the photographs, Plate XXIX-A and XXX-A.

Outside of the connected body of mountains there are many separate ridges and peaks, some of them of large size. The peaks are best shown in Yonah and Walker mountains, which are respectively 5 and 9 miles south of the general mountain mass and midway in its length in Georgia. The ridge type of separate mountains is shown in Sharptop and Pinelog mountains, which extend southwest from the Highland and in line with its principal axis. Sharptop is 7 miles distant from the Highland boundary, and a nearly equal interval separates it from Pinelog Mountain, which is the southernmost high mountain in the State.

DRAINAGE

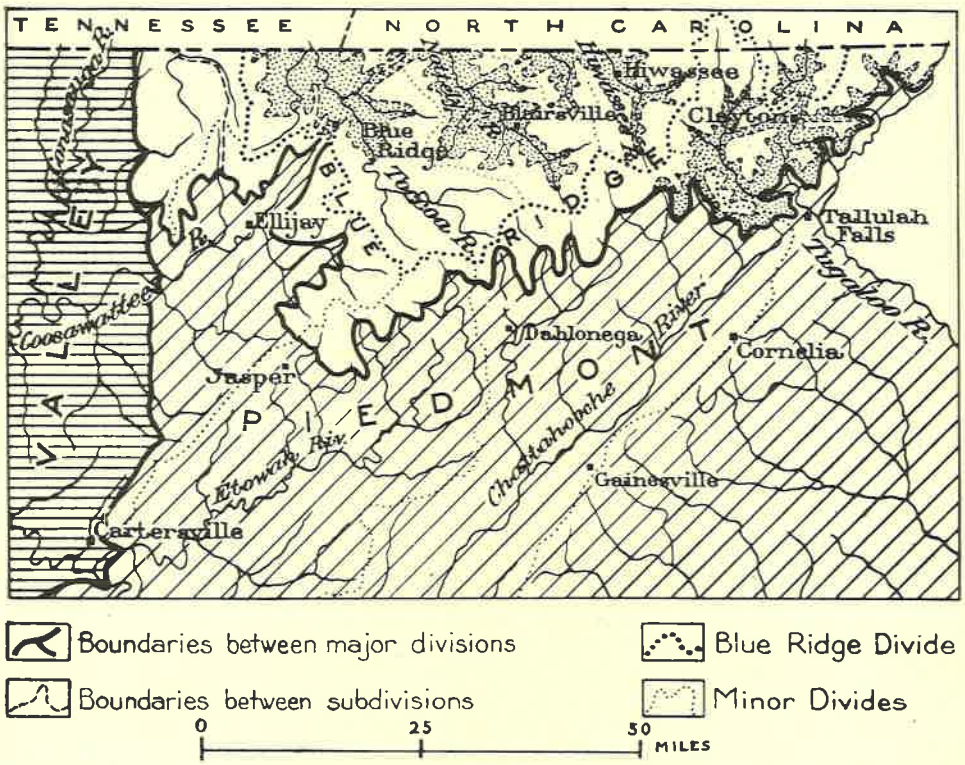
GENERAL PLAN

The natural result of erosion has been to develop the backbone of the Highland near its southeast margin. It is called the Blue Ridge for most of its length, and it extends southwestward through Sharptop and Pinelog mountains to the border of the Appalachian Valley. This backbone is the watershed of the principal rivers in northern Georgia, western North Carolina, and adjoining parts of South Carolina. A section of it with a length of 60 miles in Georgia and 24 miles in North Carolina is the central area from which the important streams radiate in all directions. These are French Broad and Tuckaseegee rivers in North Carolina: Little Tennessee and Hiwassee rivers in Georgia and North Carolina; Toccoa River of Georgia and its continuation in Ocoee River of Tennessee; Coosawattee and Etowah rivers of Georgia; Chattahoochee River of Georgia; and Tugaloo River of Georgia and South Carolina. All but the last four streams flow into Tennessee River, thence to the Mississippi and the Gulf of Mexico. The French Broad flows northeastward, the Coosawattee and Etowah westward, and the Tennessee, Hiwassee, and Toccoa flow in general northwestward from the main backbone.

Etowah River heads on the south side of the backbone, flows westward around its end in Pine Log Mountain into the Appalachian Valley, and thence southwestward to the Gulf. Chattahoochee River also flows southwestward through Georgia to the Gulf from the south side of the backbone. Tugaloo River flows southeastward from the Highland into Savannah River, discharging directly into the Atlantic and forming the boundary between Georgia and South Carolina.

RUNOFF

The traveller in the Highland is impressed by the immense number of streams and springs and the large volume of running water. There are no ponds or natural lakes, and the only bodies of standing water are those artifically created for reservoirs. The only important ones have recently been developed for water power along the branches of Tugaloo River in the northeastern part of the Highland. The drainage system of the entire region is extraordinarily complete and the streams are nowhere even sluggish. A glance at the Ellijay or Dahlonega topographic maps shows at once the perfection of the drainage system. This perfection and the steep general slopes tend to cause a rapid runoff, in a region of much rainfall, but the heavy forest cover and the deep blanket of soil absorb the water and steady its runoff. Where these controls are removed, as in the region around Ducktown and adjoining parts of Georgia, their importance is seen in the swift floods of the streams and the quick cessation of their flow The contrast is violent between these bare hills and gullied hollows. and the forested slopes of the rest of the Highland. This contrast is brought out by comparison of Plate XXXVI with Plate XXXIV and other views.



A. HIGHLAND, PIEDMONT, AND VALLEY, FROM RELIEF MODEL.
B. THE HIGHLAND, WITH ITS SUBDIVISIONS AND SURROUNDINGS.
The stippled areas represent plateaus.

PRINCIPAL BASINS

Only the headwaters of the various rivers are found in the Highland, owing to its nature as a watershed. Every river in the Highland has an Indian name, and the traveller is everywhere impressed by that fact. The rivers heading in this part of Georgia are as follows, beginning at the northeast with the rivers which flow into the Ohio and Mississippi: the Little Tennessee is 9 miles long in Georgia; Hiwassee River is 20 miles long in the State, and its branch, Brasstown Creek, is 10 miles long; these unite in North Carolina a few miles from the border. Nottely River, the principal branch of the Hiwassee, is about 30 miles long in Georgia, and joins the Hiwassee 7 miles north of the border. Toccoa River is 55 miles long in the State and becomes the Ocoee after entering Tennessee. Only headwater creeks 4 or 5 miles long represent Coosawattee River in the Highland, and most of the stream and its tributaries lie in the Dahlonega Plateau. Etowah River, which flows parallel to the main divide and south of it, is likewise represented only by short creeks from 2 to 5 miles long. Its headwaters are on the Blue Ridge at its turn northwestward along the cross range. Chattahoochee River has the same characteristics as the Etowah, but its headwater branches in the Highland are slightly longer. They drain a strip of the Blue Ridge backbone 25 miles long in a straight line, while the Etowah drains about 20 miles. The principal branches of the Chattahoochee are Chestatee River, west of the main stream, and Soque River northeast of it.

The area east of the Chattahoochee and south of the Blue Ridge is drained by tributaries of Tugaloo River. These are Chattooga River, which forms the boundary of South Carolina and Georgia and runs southwest close to the margin of the Highland, and Tallulah River, which joins the Chattooga where the latter turns from a southwestward to a southeastward course, just below the border of the Highland. Tallulah River is the main stream in the Georgia Highland south of the Blue Ridge and is 35 miles long. It heads on Standing Indian, in North Carolina 3 miles north of the State boundary, and its basin pushes the Blue Ridge far to the north out of its usual line. Chattooga River is slightly larger than the Tallulah, but it flows for some distance in North Carolina before reaching Georgia. Two miles above their junction is situated Tallulah Falls, and below it they unite to form Tugaloo River.

TRENDS

The trend of the large streams in the Georgia Highland is distinctly toward the northwest or southeast. Those which flow northwestward from the main backbone cross almost the entire Highland belt, while those flowing southeastward soon emerge from the Highland into the Piedmont plateaus. The southeastward flowing streams are much shorter than those which flow in the opposite direction and soon are gathered into a system of rivers which flow almost straight southwestward. These are Chattooga River at the northeast and Chattahoochee and Etowah rivers at the southwest. Chattahoo-

chee and Chattooga rivers are practically in line with each other and the waters of the Chattahoochee are within 10 miles of the main body of Chattooga River, the divide being about midway between them. At this point Chattooga river turns abruptly southeastward into the course which, as the Tugaloo, it maintains across the Piedmont. At the same point it is joined by Tallulah River, the longest southeastward flowing stream in the Georgia Highland.

Parallel to the Tallulah and 5 to 8 miles distant the headwaters of the Chattahoochee (Soque River), flow southeastward. Fifteen miles from the Blue Ridge this stream turns abruptly to the southwest into line with Chattooga River and maintains this course with little deviation for over 100 miles. The chief branch of Chattahoochee River is the Chestatee, which heads on the Blue Ridge 17 miles west of the head stream. This river, too, has a long southwestward course, parallel to the Chattahoocheee and close to the margin of the Highland. This southwest line is taken up by Etowah River 8 miles distant to the southwest. The Chestatee is joined by Yahoola Creek where it bends southeastward, and near their junction is the town of Dahlonega. Yahoola Creek and the head of the Etowah flow southeastward from the Blue Ridge about 5 miles apart. The peculiar plan of the Chestatee and Etowah is precisely the same as that of the Chattooga and Chattahoochee but is on a smaller scale.

A similar southwest trend is found in Ellijay River, the chief branch of the Coosawattee. The association of the Ellijay with the Murphy marble belt will be described in later pages. The two other chief branches of the Coosawattee in the Highland are Cartecay River, which flows northwestward from the main backbone, and Mountaintown Creek, which flows east of south from the Cohutta Mountains. These two streams with their northwest-southeast courses correspond to the similar trend of the Toccoa, Nottely, and Hiwassee. No such parallel arrangement is to be observed in the minor streams of the Highland, except in the narrow belt along the Murphy marble, which occupies a very small fraction of the Highland area. Elsewhere the streams have a pronounced dendritic plan, and there is very slight connection between the location of the streams and the rock formations. This is due in large measure to the great thickness and mass of the individual formations and the slight difference in hardness between their parts. The most notable adjustment of this sort is in connection with the narrow strips of hornblende schist or gneiss, which usually make depressions followed by small streams or gaps in which they head.

GRADES

There is a great range in the altitude of the streams of the Highland. All that enter the Piedmont leave the Highland at elevations a little above 1,500 feet. Of the streams which flow northwestward from the Blue Ridge, Toccoa River leaves Georgia at 1,450 feet and Nottely River at about 1,600 feet; Hiwassee River leaves the State at 1,800 feet above sea, while the Little Tennessee is about 2,050 feet. Only the headwaters of the latter are in the State, however, while the other rivers are good-sized streams where they cross the boundary.

Photographs by Arthur Keith.

A. BLUE RIDGE AND DAHLONEGA PLATEAU, LOOKING NORTHWEST FROM GRIFFIN MT NEAR CORNELIA.

B. TALLULAH GORGE, LOOKING SOUTHEAST BELOW THE FALLS.

All of the main streams of the Highland head on the Blue Ridge. Nearly all of the divide is above 3,000 feet, much is above 4,000 feet, and several points approach 5,000. The stream grades are, therefore, steep on all the streams, even on those on the northwest side which flow the farthest before reaching the 1,500 foot level. South of the Blue Ridge that level is reached in 5 or 6 miles on all streams except Tallulah River, which reaches it just above its junction with the Chattooga, twenty-five miles distant from the Blue Ridge. Just above this point, at Tallulah Falls, it descends nearly 700 feet in two miles. The side branches of the rivers north of the Blue Ridge head upon the Cross Ranges at heights similar to those of the Blue Ridge, and they have very steep grades, like the streams south of the Blue Ridge.

POWERS

The amount of energy which can be furnished by these streams is enormous. The main streams north of the Blue Ridge have sufficient volume to render their fall available for water power. The same is true of Tallulah River, but the other streams south of the Blue Ridge are small until they combine into the larger rivers on the Piedmont. Small waterfalls are very numerous, and some are of sufficient height and volume to make notable elements of the scenery. Chief of these are Tallulah Falls, shown in the frontispiece, Plate I, and Amicalola Falls near the great bend of the Blue Ridge.

Slight use has been made of this power until very recent years. A few little falls have been used to drive grist mills and sawmills, but the power developed in that way is insignificant. The power of Tallulah River is now developed by a series of modern reservoirs; these are narrow and winding, and the largest (see Plate XXXVIII-A), is 7 miles long in a straight line. The volume of the River is considerable, however, and the fall is so great that a large aggregate power is developed.

The streams of the Highland have a power capacity which is large in proportion of the size of their basis. The rainfall is high, as in other parts of the Highland; the storage is great in the deep soils which cover practically all of the area; and evaporation and runoff are well checked by the forest cover. These factors give a large volume and a steadiness of flow which is high in proportion to the steep grades, which tend to carry the storm water off rapidly and leave periods of low water. There are no natural reservoirs for steadying the flow by storage, and the difficulties of securing artificial ones are well seen on the Tallulah. Considerable storage basins can be secured in the upper waters of the northwestward-flowing streams, where their channels are not cut deeply into the plateau margins. Farther down stream, however, the channels are deep trenches which provide even less storage than on the Tallulah. Suitable parts of these principal valleys for storage are illustrated in Plates XXXI-A and XXXVII-A illustrating the upper part of the Hiwassee basin, and unsuitable parts are shown in Plate XXXIII-B, a view on Ocoee River in Tennessee, a few miles from the State boundary.

RELIEF

GENERAL PLAN

The Highland mass is divided into two groups of mountains, the eastern of which is about four times as large as the western. These two groups are widely separated at the south by the Dahlonega Plateau in the basin of Coosawattee River. Where the two principal branches of this river unite is situated the town of Ellijay. Northeast of Ellijay the principal arm of the Plateau extends up Ellijay River, becoming narrower until it is scarcely over one-half mile wide where it crosses the divide into the basin of Toccoa River. At this point is situated the town of Blue Ridge. Northeastward the plateau country expands greatly again and has the general shape of an oak leaf, with the tips denting into the mountains. This district is called the Ducktown Plateau. Another narrow valley similar to that of Ellijay River crosses the northeastern divide of Toccoa River and passes into North Carolina in the basin of Nottely River. There it expands into another plateau, the Hiwassee Plateau, but of this only the southern tips enter Georgia along Nottely and Hiwassee rivers and Brasstown Creek. A similar but even narrower plateau from 1 to 1½ miles wide enters Georgia along the headwaters of Little Tennessee River and passes through Rabun Gap into the drainage basins of Chattooga and Tallulah rivers in the northeast part of the Highland.

The main backbone of the mountains, the Blue Ridge, lies near their southerly border in Georgia, North Carolina, and Tennessee, and from it the streams flow either northwest or southeast. This is a winding divide for most of its length, between the waters of the Mississippi basin and those that flow directly toward the Atlantic or the Gulf of Mexico. The general course of the divide and of the backbone of the mountains is S. 60° W. for two-thirds of its length in Georgia, and it continues northeastward into North Carolina with similar direction and characteristics. The southeastward-flowing streams are short in the Highland, being in all cases small branches of larger rivers which flow southwest in the Dahlonega Plateau. The northwestward-flowing streams are much larger and have easier grades, except close to their headwaters. In the Highlands all but one of them are branches of Tennessee River, and their courses are roughly parallel and at right angles to the main backbone.

Between these rivers and the plateaus which follow them, high ranges extend northwestward across the Highland and into North Carolina and Tennessee. They are interrupted only along the narrow intermountain valley already described. These Cross Ranges are of practically the same heights as the main backbone, and in this respect as well as in their general plan they are duplicates of the even higher ranges in North Carolina. Except for the narrow Ellijay intermountain valley, the Cross Ranges extend to the Appalachian Valley, and they close in so completely toward the northwest that the Ducktown and Murphy plateaus find an outlet only through narrow, rugged canyons. Their character is shown in Plate XXXIII-B

a view of Ocoee River 3 miles north of the State boundary. The Coosawattee alone escapes into the Appalachian Valley around the western mountain mass, where the Dahlonega Plateau borders the Valley.

The name Blue Ridge is applied to the main backbone of the mountains, from North Carolina southwest to the divide between Toccoa and Coosawattee rivers, a distance in a straight line of 59 miles. Thence one of the Cross Ranges is called the Blue Ridge, running for 20 miles northwest along the divide of Toccoa River to the notch of Ellijay Valley, and thence 30 miles farther northwest to the Appalachian Valley, as shown in Plate XXIX-B. For the latter half of the distance the divide lies along the Big Frog Mountains in the western body of the Highland. Between this point of the Blue Ridge and the Valley stands a tangle of high mountains loosely called the Cohutta Mountains. The line of the backbone is continued, southwest of the great bend at the head of the Toccoa, in the Burnt and Amicalola mountains of the Highland (See Plate XXXII-B) and in Sharptop and Pinelog mountains of the Central Upland. This extension of the backbone is the divide between two rivers of the Gulf drainage.

TRENDS

Mention has been made of the general southwest trend of the backbone of the mountains and of the northwestward trend of the Cross Ranges. In detail, however, the course of the backbone is very crooked, and it is nowhere straight for more than a mile or two. Its greatest divergence is northward around the head of Tallulah River, where it goes back into North Carolina for a few miles. Here the backbone goes northward out of its general course for 12 miles, but elsewhere the divergence from the general line is seldom more than 2 miles. Similar but smaller irregularities are found along the Cross Ranges. The western or Cohutta group of mountains shows the greatest irregularities and very little system. The trend of the main valleys between the Cross Ranges is about parallel to the Ranges. The chief exception to this plan is Ellijay Valley and its northeastward extension, as is seen in Plate XXXII-A. This cuts directly across the larger features of the region and follows very closely a belt of weak slates and soluble marbles. This is the only large topographic feature the location of which is directly due to individual rock formations, since all of the other principal features cross the formations and are scarcely affected by them.

The trend of the minor ridges and valleys is exceedingly variable. The rivers divide towards their heads into a multitude of branches like the limbs of a tree or the veins of a leaf, and the small ones run together from all directions. Similarly the high ranges break down into a network of spurs, which pass out into the lower ground in every direction. The basins of Hiwassee River north of the Blue Ridge and Tallulah River south of it are excellent examples of these networks. Settlement and travel are thus necessarily focused into a belt along each principal stream. This dendritic plan of the streams

from which results the similar plan of the ranges and hills, is unusually strong in the Highland, perhaps more so than in most sections of the Appalachian Mountains. A notable exception is furnished by Ellijay Valley and its extension into the Hiwassee basin of North Carolina. The minor valleys and small ridges which occupy this depression run northeast and southwest in parallel courses until they emerge upon the Dahlonega Plateau and pass out of the mountains. In the Plateau also they follow the weak rock belts and curve into south and then southeast courses close to the south end of the Highland.

TYPICAL FORMS

The individual summits of the Highland have two general kinds of form—somewhat conical peaks or broad rounded summits. The long narrow crest lines of even height which are so numerous in the Appalachian Valley are nowhere seen in this Highland. The nearest approach to them appears in a few of the ridges along Ellijay Valley. Most of the peaks stand on the Blue Ridge and the highest parts of the Cross Ranges. Rabun Bald is typical of this class, as are also Blood Mountain and Brasstown Bald around the headwaters of Nottely River. Great peaks like these are most common along the divide between the large river basins, but small knobs and peaks dot the various ridges and spurs at all altitudes. The rounded crests are by far the most common, however, even on the major divides. Practically no other kind is seen in the plateaus and the valleys which branch from them, and the typical outline is a curve. The valley bottoms, too, show gentle curves which rise faster toward the headwaters. The streams head in steep, narrow ravines, and the spurs merge into the rounded mountain crests. Plate XXXI illustrates typical mountains and valleys.

The general angle of slope is decidedly steeper southeast of the main backbone, and the descent to the Dahlonega Plateau is accomplished by both streams and spurs in 4 or 5 miles, except in the Tallulah basin, while northwest of the backbone the distance to the equivalent parts of the plateaus is at least twice as great. This is most plain near the great bend of the Blue Ridge, where the southerly slope is a decided scarp. Even on the steepest slopes large cliffs are rare in the Highland. Ledges are very numerous, but the bed rock is usually covered by soil and vegetation. Occasionally on steep slopes this is stripped off by landslides, especially where the roots and vegetation have been killed by fires.

ALTITUDES

The Highland of Georgia is a formidable barrier to traffic and settlement, and it can be crossed at only two points without a heavy climb at the divide. One is at Rabun Gap, where a railroad passes from the Chattooga to the Little Tennessee basin with scarcely perceptible grade. Here the Indians had their main trail across the Highland, and the white settlers made their first rough road 200 years ago. The Ellijay Valley and its northeast extension furnishes a simi-

Photographs by S. W. McCallie.

A. HIWASSEE VALLEY LOOKING NORTH FROM MOUNTAIN SCENE.
B. TRAY MOUNTAIN LOOKING SOUTHEAST FROM MOUNTAIN SCENE.

lar passway, but does not cross the entire Highland. In other situations the basins of the rivers are tracts so set apart that communication between them entails arduous climbing.

The largest body of high ground lies along the Blue Ridge, which occupies more than two thirds of the Highland. The high tracts are by no means limited to that position, however, and equally high ground is found upon the Cross Ranges. The highest point in the Highland is Brasstown Bald, 4,768 feet, on the the divide between Nottely and Hiwassee rivers nearly 4 miles from the Blue Ridge. Almost equally high is Rabun Bald, 4,600 feet, on the Blue Ridge in the northeast corner of the Highland and 2 miles from the North Carolina boundary. The highest point on the Blue Ridge in or near Georgia is Standing Indian, 5,500 feet, at the head of Tallulah River in North Carolina 3 miles north of the boundary. Little Bald and Ridgepole are also near the head of Tallulah River in North Carolina and within a mile of the boundary, each point being slightly above 5,000 feet. One mile south of Little Bald and in Georgia Chestnut Mountain is 4,600 feet above sea. Scattered at intervals of a few miles along the Blue Ridge there are 14 peaks above 4,000 feet, most of them in its eastern half. Practically the entire extent of the Blue Ridge stands above 3,000 feet, except near Little Tennessee River and near Ellijay and Cartecay rivers, the headwater branches of the Coosawattee. On the Cross Ranges running northwest from the Blue Ridge there are 14 points above 4,000 feet in addition to Brasstown Bald, the highest peak. In the western group of mountains only Big Frog Mountain and two other peaks are higher than 4,000 feet, but 12 peaks exceed 3,500 feet. The southwestward extension of the backbone from the Blue Ridge is distinctly lower, but has many points between 3,000 and 3,500 in Amicalola and Burnt mountains.

The plateau base from which the Highland rises is more uniform in height, and stands from 1,600 to 1,800 feet above sea along its entire margin, except for a few miles at the west where Cohutta Mountain rises directly from the Appalachian Valley. The intermountain plateaus stand at similar heights, the Ducktown, for instance, being for the most part 1,600 or 1,700 feet above sea; but around its upper end there is a fringe or margin of a still higher plateau, which stands a little above 2,000 feet above sea. The Hiwassee Plateau (See Plate XXXI-A), is at this higher level of 2,000 to 2,100 feet for much of its area. All of these plateaus are cut into by the streams, which flow in trenches from 50 to 700 feet deep. Little Tennessee River is an exception to this rule and still flows on the original graded surface, for the trenching by the stream has not yet reached to the headwaters. This is illustrated in Plate XXXVIII-B.

CAUSES OF RELIEF

The relative heights in the Georgia Highland are determined by two principal factors. Most important, are the relative resistance of the rocks to decomposition, and the general relation of the rocks to the surface as stated in the Table of Formations, pages 6 and 7.

Certain rocks, especially the Murphy marble, are readily dissolved by circulating waters containing acids. Other rocks, such as granites and gneisses which contain feldspar, break down in a similar way but to a much less degree. Rocks which contain much quartz yield slowly to this process. The Tusquitee and Nottely quartzites are the last to be worn down by solution, since they are nearly pure quartz. The Great Smoky conglomerate, the granites, and many beds of the mica gneisses contain much quartz and are correspondingly slow to be reduced. The rocks which contain hornblende, such as diorite, gabbro, and hornblende gneiss, are more readily broken down than the mica gneiss or granites and usually underlie depressions. This is particularly the case where the bands of hornblendic rocks are narrow, and in this way are caused many of the notches and gaps in the Blue Ridge and the Cross Ranges. Of intermediate character are the slates, phyllites, and schists. These form low ridges and plateaus which extend a few hundred feet above the Murphy marble valleys but nowhere make high mountains. The Nantahala slate occupies the highest ground of these formations and tends to form high rounded knobs which rise a few hundred feet above the adjoining formations. The schists and phyllites, which are composed mainly of mica and quartz, break down rather easily through their numerous parting planes, but complete decomposition is very slow. There results a litter or carpet of small schist fragments which covers the surface of the ground and prevents its removal, even though the bedrock is covered by a deep layer of soil. This carpet is most plainly to be seen in the region around Ducktown, Tenn., and adjoining portions of Georgia where the vegetation has been killed by the fumes from the smelters.

The second principal factor in controlling the height of the region is the position of any particular area in relation to the stream. Since the land is reduced finally by removal of the soils and rock particles through the streams, it is evident that the largest streams are most effective. Accordingly the reduction of the surface is greatest near the large streams and is least around their headwaters. To this factor is due the prevalence of plateaus and open valleys near the large rivers and the mountainous character near the divides between them. The rivers flowing northwest from the main backbone of the mountains are perfect illustrations of this process. In those basins the same rock formations extend directly across basin after basin and range after range, so that the unequal hardness of the formations is seen to exert only a minor control, while the major role is played by the size and position of the stream. An exception to this, and almost the only one, is the narrow valley along the Murphy marble.

BLUE RIDGE

Position and limits. The Blue Ridge forms the outer part of the Georgia Highland, and the area of the Highland lying north of it is twice as large as that lying to the south. The Blue Ridge was first seen from the south by the white explorers as a faint blue belt on the far-distant horizon. It is visible for 50 or 60 miles in clear

weather and is always blue from the haze of the atmosphere. Only a few miles from the Ridge is the blue replaced by the green of its heavy forests, and the name Blue Ridge is notably fitting.

The marginal position of the Blue Ridge is interrupted where the Cohutta Mountains stand between the Ridge and the Appalachian Valley. A smaller exception forms the extreme southern point of the Highland, where Amicalola and Burnt mountains project southwestward from the main Blue Ridge as it turns northwest around Toccoa River basin. In the eastern part of the Highland, also, Tallulah, Glassy, and Rainy mountains extend southeastward from the Ridge along the divides between Tallulah, Chattahoochee, and Chattooga rivers. They are loosely tied to the Blue Ridge mass through ridges 2,000 or more feet in height.

The northeast corner of Georgia, where that State, North Carolina, and South Carolina unite, is at Ellicott Rock in Chattooga River, well up toward its headwaters. The crest of the Blue Ridge enters Georgia from North Carolina 10 miles almost west of the Rock, and passes out of Georgia into Tennessee 8 miles west of the point where Toccoa River crosses the boundary. These two points on the Blue Ridge are 78 miles apart, but the actual length of the Blue Ridge between them is over twice as great because it is so crooked. Immediately after entering Tennessee the Blue Ridge turns sharply west, only one or two miles from the State boundary, and comes to the Appalachian Valley in eight miles.

The southern boundary of the Blue Ridge is formed by the Dahlonega Plateau, which is in the vicinity of 1,600 feet above sea level through the entire length of the Blue Ridge. The boundary of the Blue Ridge on the north is much harder to define. Strictly speaking, the Blue Ridge consists of the ridge which limits the Mississippi waters on the south. To that must, of course, be added a wide border composed of spurs directly connected with the Blue Ridge proper. This by no means includes all the high ground, however, as important ranges run off to the northwest from the Blue Ridge. These are not separated from the Ridge by deep gaps, but are as directly connected with it as any of the parts to which the name is applied.

For many reasons it would be more natural to extend the name Blue Ridge southwestward along Amicalola and Burnt mountains, which form part of the principal backbone of the mountains in line with most of the Blue Ridge. The divide formed by these mountains, as is shown in Plate XXIX-B, continues southwestward into the Dahlonega Plateau and there is marked by two of the principal mountains which lie outside the Highland. It further extends, with only one short interruption, practically to the Gulf Coastal Plain. This, geologically speaking, is a more proper location for the term Blue Ridge. As it is used, however, the Blue Ridge in its northwesterly course follows one of the major cross ranges on the west side of the Toccoa basin, which corresponds precisely to that on the east side and to that between Nottely and Hiwassee rivers. Other great cross ranges of identical character strike off northwestward from

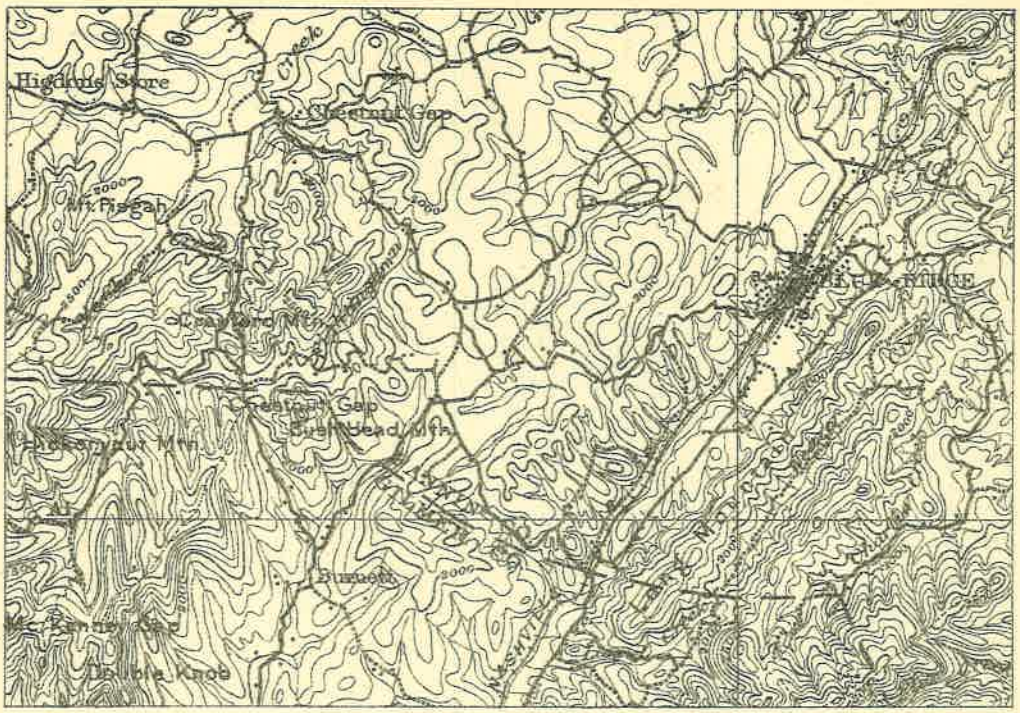
the Blue Ridge in North Carolina at short intervals throughout its extent in that State. The only point in which this particular northwest range called Blue Ridge differs from the others is in the fact that it is the southern limit of the drainage basin of the Mississippi River. It is interesting in this connection that the earliest map giving an actual position for the Appalachian Mountains (under the name Apalachean Mountains), represents their main range in the position now assigned to the Blue Ridge.

System and trend. The crest line of the Blue Ridge has a general course of S. 60° W., from the northeast corner of the State to the south end of the basin of Toccoa River. There it turns abruptly northwestward in a general course N. 35° W., to the point in Big Frog Mountain where it leaves the State. These general courses are locally much modified, so that there are few stretches of the actual Blue Ridge crest which are even moderately straight. On the chief bend, that around the Tallulah, the Blue Ridge sweeps back into North Carolina for 10 miles and forms the wildest section of the Highland. It is a notable fact that each important river which heads on the Blue Ridge pushes the crest of the Ridge back between the basins of the other streams; those from the southeast alternating with those from the northwest, and those from the southwest with those from the northeast. The striving of the different streams to extend their basins headward has thus resulted in a major topographic feature which is the most crooked in the Appalachian Mountains.

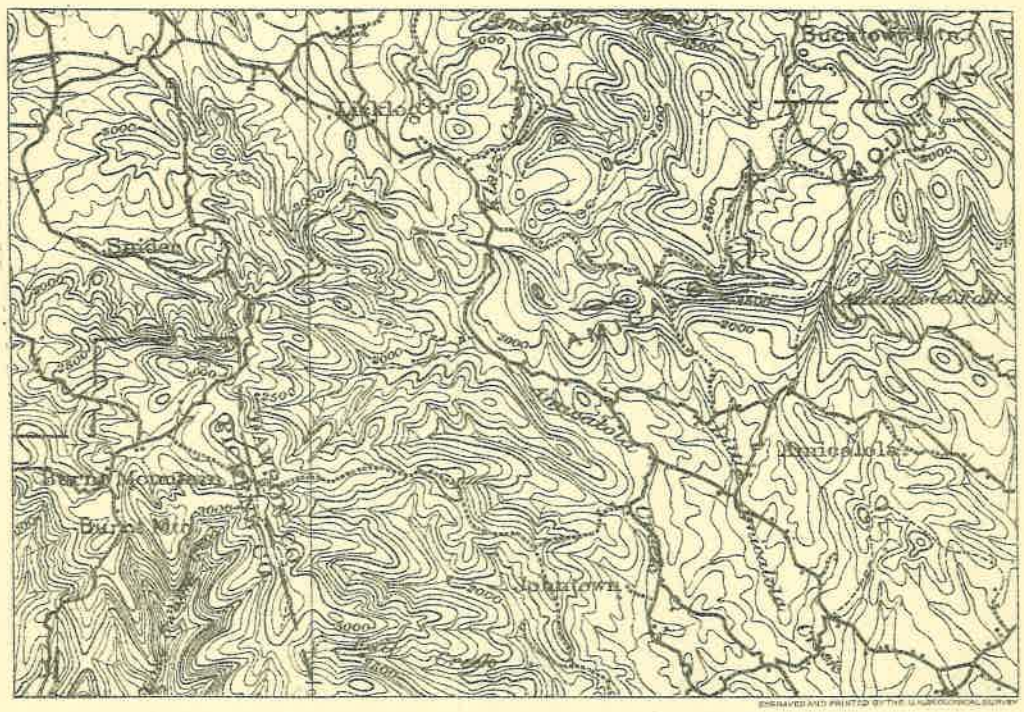
Several of the minor valleys in the Toccoa basin have been cut into and captured by branches of the Etowah, and others are still losing ground. A similar situation appears at the head of Tallulah River, which is encroaching fast on the upper basin of Nantahala River in North Carolina. Nearly all the grades of the streams and of the ground are steeper on the southeast or southwest sides of the Blue Ridge,—in other words, away from the Mississippi basin. The same thing is true on the extension of the mountain backbone through Amicalola and Burnt Mountains, where the drop to the south is much greater than that to the north.

Topographic forms. The Blue Ridge as a divide is almost continuously high. At two points it is formed by narrow plateaus, one of 1,750 feet, between Ellijay and Toccoa rivers, mapped in Plate XXXII-A, and the other 2,100 feet, in Rabun Gap, between the Little Tennessee basin and that of Chattooga River, as is shown on Plate XXXVII-B. Both of these passes are bordered closely by mountains above 2,000 feet in height, which are themselves only spurs from the main mountain masses. By far the greater part of the Blue Ridge is above 3,000 feet in height, and the various sections of that sort are only separated by a few narrow notches or gaps. The lowest stretch of importance runs southwestward from the town of Blue Ridge for a straight distance of 5 miles; all of this is in the vicinity of 2,000 feet above sea.

Many of the peaks of the Blue Ridge stand 4,000 feet or more above sea level and a few above 4,500 feet. The crest line is about as



A. PARALLEL VALLEYS CONNECTING THE ELLIJAY VALLEY AND THE DUCKTOWN PLATEAU



B. HIGH PLATEAU AND SCARP OF AMICALOLA AND BURNT MOUNTAINS

Parts of the Ellijay sheet

Scale $\frac{1}{125000}$

1 ½ 0 1 2 3 4 5 Miles

Contour interval 100 feet

Datum is mean sea level

irregular in height as it is in position, and stretches that are even comparatively level are exceedingly scarce. In this respect the Blue Ridge forms a very great contrast with the mountains of the Cumberland Plateau. The different parts of the Blue Ridge have a generally rounded form and even the crests are either peaked or rounded. Thus the traveler in nearly any direction is going either uphill or downhill, and the difficulty in traveling along the Range is as great as that in crossing it. This separation of the ridges into individual tops, whether rounded or conical, is thoroughly characteristic of the Highland, and the proportion of land which is fairly level is extremely small. This general condition is of the greatest importance to travelers on foot or in vehicles, to the farmers, and to all persons who enter the Highland. These features are so pronounced and so unalterable that the Blue Ridge and its adjuncts will always remain a region thinly populated and, in the main, wild. In a few localities, such as Burnt Mountain and Amicalola Mountain, the summits are plateau-like and smoothly rounded as can be seen in Plate XXXII-B, at altitudes of about 3,200 feet. The summits of this plateau are gently rounded like those of the other plateaus, but they are more deeply trenched by the streams, and the remnants are small. A small plateau is seen in the headwaters of Toccoa River and along the Blue Ridge between the Toccoa, Etowah, and Chestatee basins, with summits from 3,000 to 3,200 feet above sea.

The summit of Flat Top Mountain in the northwestern part of the Blue Ridge may be considered to represent a still higher plateau. For a length of 6 miles its summits are between 3,400 and 3,600 feet in height and are broad and rounded. Their character is shown in Plate XXXIV-A. At the same height, but at the other end of the Blue Ridge, a plateau is well developed on an easterly branch of Little Tennessee River. This plateau barely extends across into Georgia but is one of a large group at the same height in North Carolina.

A few valleys in the Blue Ridge reverse the usual rule and have broad, open upper reaches and steep narrow gorges in their lower parts. They are associated with the plateaus and are typical "hanging valleys," indicating that their streams have been captured and diverted. The most striking of these is on Amicalola Mountain, where a stream flows with a gentle grade for 2 miles, and then pitches abruptly down the mountain for 500 feet and forms Amicalola Falls, the most picturesque in the Blue Ridge. Similar but larger is the valley of Mud Creek, an eastern tributary of Little Tennessee River. This flows in an open plateau valley for 3 miles and then tumbles 500 feet into a narrow chasm; thus is formed Eastatoah Falls, the second principal fall in the Blue Ridge. The largest example of this is Tallulah Falls. Above the Falls the entire River lies on or above the Dahlonega Plateau, but at that place the stream drops 700 feet in two miles into a deep chasm in the Plateau. The River bed is lined with falls and rapids, and the most noted is shown in the Frontispiece, Plate I.

Altitudes. The Blue Ridge is highest in its eastern half, both in the individual peaks and in the total amount of high ground. There is a general diminution in height about midway in its length, where Toccoa River heads. At that point, Blood Mountain, the highest ground runs northwestward along one of the Cross Ranges for 9 miles, and contains peaks several hundred feet higher than those of the Blue Ridge to the southwest. East of Blood Mountain there are 21 peaks in Georgia of 4,000 or more feet, whereas west of it there are only six. The highest point in Georgia, Brasstown Bald, (Mount Enota) 4,768 feet, is on the eastern Cross Range almost 4 miles northwest of the Blue Ridge. Hightower Bald, 4,567 feet, is 1 mile west of the Blue Ridge, and half a mile south of the boundary. The second highest point in the State, Rabun Bald, is on the Blue Ridge 2 miles south of the State boundary, and east of the Little Tennessee basin. Points of greater height are found on Blue Ridge where it makes its great curve back into North Carolina, including Standing Indian, 5,500 feet, and Little Bald, 5,035 feet. On a spur south of Little Bald stands Chestnut Mountain, 4,600 feet in height, which vies with Rabun Bald for the position of second highest mountain in the State. Beginning with Rabun Bald and proceeding along the south side of Little Tennessee basin the highest peaks are in order as follows:

Rabun Bald	4,600 feet
Rocky Mountain	4,000 feet
Raven Knob	3,600 feet
Pinnacle	3,600 feet
Black Rock	3,700 feet
Unnamed peak	3,500 feet
Unnamed peak	3,700 feet
Unnamed peak	4,000 feet
Ridgepole, in North Carolina	5,008 feet

In the basin of Tugaloo River the following are the highest points:

Glady Mountain, almost at the corner of the State	3,700 feet
Chestnut Mountain	4,600 feet
River Mountain	3,872 feet
Unnamed mountain	3,631 feet
Rainy Mountain	2,900 feet
Screamer Mountain	2,800 feet
Tiger Mountain	2,800 feet
Glassy Mountain	3,521 feet
Charlie Mountain	3,034 feet
Oakey Mountain	3,209 feet

The latter is a peak of the Tallulah Mountains on the divide of Tallulah and Soque rivers.

In the Hiwassee basin near the Blue Ridge are the following peaks:

Rich Knob	4,100 feet
Hightower Bald	4,567 feet
Wildcat Knob	4,000 feet
Rocky Mountain	4,164 feet
Eagle Mountain	4,280 feet
Bell Mountain	3,446 feet

Between Tallulah and Hiwassee rivers there are the following summits:

Unnamed peak, 1 mile north of the boundary	4,600 feet
Unnamed peak	3,600 feet
Unnamed peak	3,697 feet
Powell Mountain	3,800 feet
Unnamed mountain	4,288 feet
Unnamed mountain	3,808 feet
Dismal Mountain	3,900 feet
Unnamed Mountain	3,900 feet

Between the Hiwassee and Chattahoochee basins the mountains rise to the following heights:

Tray Mountain	4,398 feet
Rocky Mountain	4,060 feet
Blue Mountain	4,045 feet
Unnamed Peak	4,011 feet
Jacks Knob	3,800 feet

On the divide at the south headwaters of Nottely River are:

Horse Trough Mountain	4,052 feet
Sheep Rock Mountain	3,600 feet
Strawberry Top	3,744 feet
Cowrock Mountain	3,867 feet
An unnamed peak	3,700 feet
Levelland Mountain	3,942 feet
Blood Mountain	4,463 feet

The southeastern divide of Toccoa River is decidedly lower and includes these peaks:

Unnamed peak	3,642 feet
Unnamed peak	3,759 feet
Black Mountain	3,800 feet
Unnamed peak	3,619 feet
Springer Mountain	3,820 feet

Here the Blue Ridge turns northwestward. Its southwestern prong, Amicalola Mountain, contains Black Mountain, 3,600 feet, and Bucktown Mountain, 3,400 feet, and Burnt Mountain, on the same projection, has one point of 3,300 feet and several of 3,200. The south end of this group, 4 miles south of Burnt Mountain, is Grassy Knob, 3,290 feet. This is the southernmost projection of the Highland into the Piedmont Upland, and furnishes an extraordinarily comprehensive view over the Highland and the Upland.

In the northwestward course of the Blue Ridge there are the following summits:

5 unnamed mountains	3,400 to 3,500 feet
Wolfpen Mountain	3,400 feet
Tickanetly Bald	4,054 feet
Turniptown Mountain	3,800 feet
Rich Mountain	4,081 feet
Little Bald	4,021 feet
Big Bald	4,120 feet
Cold Mountain	3,200 feet
Rocky Mountain	3,541 feet

There the Blue Ridge drops down into the deep Ellijay Valley; west of this are the following points:

Flattop Mountain, south end	3,500 feet
Flattop Mountain, north end	3,600 feet
Unnamed peak	3,200 feet
Hemp Top	3,600 feet
Big Frog Mountain (In Tennessee, 1 mile from the boundary)	4,200 feet

The lesser summits and the knobs which dot the many spurs exhibit an endless variety of heights above the Dahlonega and Ducktown plateaus, which stand at 1,600 to 1,700 feet or above the Hiwassee and Little Tennessee plateaus, between 2,000 and 2,100 feet. The Little Tennessee Plateau crosses the Blue Ridge and forms its southern base in small parts of the Tallulah and Chattooga basins.

The minor valleys in the Blue Ridge have a vertical range between 1,000 and 2,000 feet. The 2,000-foot level is from 2 to 7 miles away from the Blue Ridge at the north, and from one-half to 3 miles distant on the south. It is farthest from the Blue Ridge in its northeastern portions, but the general level of the ground is higher there so that grades are similar throughout. The chief exception to this general relation lies in the cross valley of Ellijay River, where the Blue Ridge is 250 feet below the 2,000-foot level.

Drainage. The streams which drain the Blue Ridge fall into three groups: (1) those flowing southeast from the Blue Ridge directly to the Atlantic, represented by Tugaloo River; (2) streams which flow directly to the Gulf of Mexico, including the Chattahoochee, Etowah, and Coosawattee; and (3) those which flow northwest from the Blue Ridge into Tennessee and Mississippi rivers, including Toccoa, Hiwassee, and Little Tennessee rivers.

The principal branches of Tugaloo River in Georgia are Chattooga and Tallulah rivers, the latter being the continuation of the main stream. Stekoa Creek, a branch of the Chattooga, heads in Rabun Gap against Little Tennessee River, and the valley along their upper waters is part of the noted pass through the Blue Ridge.

The eastern branch of Chattahoochee River is Soque River, which heads close to Tallulah River. West of this lies the head of the main stream and still farther west is its branch Chestatee River. All of these headwaters of Chattahoochee River which are in the Blue Ridge are of about the same size. These two rivers, Tugaloo and Chattahoochee, drain nearly half of the southern side of the Blue Ridge.

Just west of the Chattahoochee is the head of Etowah River. Two of its branches of about the same size as the main stream drain the southwestern prong of the mountain backbone, none of them being important.

In its northwest course the Blue Ridge is drained by branches of Coosawattee River, which are, from south to north, Talking Rock Creek, Cartecay River, Ellijay River, and Mountaintown Creek. All of these streams are short in the Blue Ridge. The northwest corner of the Blue Ridge in Big Frog mountains is drained northwest-

Photographs by Arthur Keith.

A. BARLOW CUT, THREE MILES SOUTHWEST OF DAHLONEGA.
B. OCOEE GORGE, THREE MILES NORTH OF STATE BOUNDARY.

ward through Conasauga River and its branch, Jacks River, into the Coosawattee in the Appalachian Valley.

North of the Blue Ridge, Toccoa River lies in a basin parallel to the northwest course of the Blue Ridge and flows through Ocoee River into the Tennessee. The Toccoa has four large branches, Coopers, Noontootly, Hemptown, and Fightingtown creeks. Parallel to Toccoa River and northeast of it Nottely River, Brasstown Creek, and Hiwassee River, all flow northwestward into North Carolina. Brasstown Creek and Nottely both join the Hiwassee a few miles north of the State boundary. The principal branch of Nottely River is Young Cane Creek, which enters from the southwest, and the important branch of Hiwassee River in Georgia is Hightower Creek. The most eastern river which flows north from the Blue Ridge is the Little Tennessee. Only a few miles of this stream are in Georgia, but it is important because of the low pass which it has cut through the Highland.

The stream trends in the Blue Ridge have already been discussed in connection with the valleys and ridges, but attention is invited again to the general northwest or southeast flow of the chief streams. This definite system is emphasized by the general trend at right angles to it in the adjoining Dahlonega Plateau. The tributaries and small branches, however, have an endless variety of direction and show typical dendritic plans. All of the basins in the Blue Ridge are alike in this respect, whether their flow is to the Gulf, to the Atlantic, or to the Mississippi. Each stream flows nearly along the central axis of its basin, so that the tributaries on either side have similar lengths.

The only important exception to this plan is in the Toccoa basin, where the headwater erosion of Ellijay River has pushed the divide northeastward until it is hardly more than two miles from the channel of the Toccoa. Both north and south of this point, however, the divide recedes from the River, which has its usual symmetrical position in its basin. Chattooga River also has an unsymmetrical position in its basin, which becomes even more marked after it passes into the Dahlonega Plateau. In this respect it strongly resembles Chattahoochee River, which in places is within a mile or two of its southeastern divide. The two rivers are directly in line with each other and flow southwestward.

The grades of the streams which flow out from the Blue Ridge are materially different on its opposite sides, and as a whole, those which flow directly to the Atlantic are the steepest. The stream channels are higher toward the northeast on all these rivers, but the height of the ground is greater in the same direction, so that the average stream grades are similar for them all. The smallest average grades are found on the rivers north of the Blue Ridge, which are much alike in all particulars. They have cut their channels deep into the mountain mass, and they reach the 2,000-foot level only 2 to 7 miles from the Blue Ridge. There the streams are at the level of the Hiwassee Plateau, and they descend below it only 200 to 400 feet before

leaving the State. Above this general level the grades rapidly steepen up the headwater branches, with many rapids and falls.

The southward-flowing streams exhibit similar changes of grade, but they reach the 2,000-foot level much sooner than do those north of the Blue Ridge. The difference is least between the heads of Nottely and Chattahoochee rivers, where the 2,000-foot level on each stream is about equally distant from the Blue Ridge.

COHUTTA MOUNTAINS

Position and limits. The northwest corner of the Highland is cut off from the main body of the mountains by Ellijay Valley and the Ducktown Plateau. The mass thus set off is divided into two roughly equal parts, the eastern of which goes under the name Blue Ridge and has been described with the rest of the Blue Ridge. The western and slightly larger part is called the Cohutta Mountains, but the name is somewhat indefinitely applied. The main part of the high ground is at the north, but there is also an important tract of high ground at the south nearly cut off from the main body. Both parts are called Cohutta Mountain, and there are in addition numerous names for individual peaks.

The area thus outlined is 20 miles long from north to south and nearly 12 miles wide in its northern third. At the south the mountains terminate in a single ridge (Cold Spring Mountain), which is 3 miles from the Valley and nearly surrounded by the Dahlonega Plateau. The Cohutta Mountains are separated from the Blue Ridge by the deep gorge of Jacks River on the north and by an arm of the Dahlonega Plateau at the south on Mountaintown Creek. Between the heads of these two streams there is a narrow connecting ridge, on which even the gaps are above 3,000 feet.

At the west the Cohutta Mountains are bounded by the low plains of the Appalachian Valley, and the boundary as a whole runs nearly north and south. This limit of the Mountains is very plain, and Fort Mountain and Cohutta Mountain rise within a mile of the Valley borders to heights above 2,800 feet. The valley floor at the foot of these mountains is only 800 feet above sea level, and the bold character of the boundary is shown on the map, Plate XXXV and the photograph Plate XXXIX-B. Both south and north of these points narrow tracts of the 1,600-foot plateau intervene between the Valley and the actual mountain slopes. Even the plateaus rise abruptly in steep hills 500 or 600 feet above the Valley floor, however, and the general aspect of the country changes there materially. This boundary departs from its general north-south course in only one place; this is nearly midway in its length where an arm of the Valley enters the Mountains for 3 miles along Holly Creek, as is illustrated in Plate XXXV. The continuation of this depression eastward divides the Cohutta Mountains into the two parts before mentioned. The southern and southeastern boundaries of the Cohutta Mountains are set where the tops of the Dahlonega Plateau curve quickly upward into the mountains slopes, at various heights between 1,600 and 1,800

Photographs by C. W. Hayes.

A. COHUTTA MTS. LOOKING SOUTHWEST FROM FLATTOP MT. ON THE BLUE RIDGE.
B. DUCKTOWN PLATEAU AND BLUE RIDGE LOOKING NORTHWEST FROM CHESTNUT GAP.

feet. This line is rather crooked and has reentrants of various sizes up the streams.

System and trend. The lines of high ground in the Cohutta Mountains are very irregular; the principal divide is at the east and trends rather uniformly a little west of south. Two subordinate divides spring from this in a westerly direction—one in the northern and one in the southern section. Between the minor divides lies the cross valley of Holly Creek above mentioned. These major trends appear to have no relation to the structure or distribution of the rock formations, and in fact nearly all of the mountain area is underlain by a single formation, the Great Smoky.

The outline of the Dahlonega Plateau and the Mountains does not agree at all with the distribution of the rocks. On the northwest side of the Mountains, however, the descent to the 1,600-foot plateau agrees rather closely with the boundary between the Great Smoky formation and the Hiwassee slate, and all trend nearly northeast. Here the minor ridges and valleys run with the rock formations nearly as plainly as in the Ellijay Valley.

Altitudes and forms. The Cohutta Mountains are a region of strong relief, except along the inner parts of the 1,600 foot plateau. The west base of the Mountains stands in the Appalachian Valley between 800 and 1,000 feet, being slightly higher at the north; the east base is between 1,600 and 1,800 feet along the Dahlonega Plateau. The mountains themselves rise to heights in the vicinity of 3,000 feet and a few peaks are over 4,000. The total relief from crest to base is thus between 2,000 and 3,000 feet.

The altitudes of the Cohutta Mountains are similar to those of the other mountains in the Highland. The entire crest of the northern part of the range is above 3,000 feet and half of it is above 3,500 feet. In the southern part almost all is above 2,600 and all is less than 3,000 feet. Cowpen Mountain, the highest point, is 4,166 feet above sea, Potato Patch Mountain is 3,500 feet, Big Bald Mountain, 3,900 feet, and Grassy Mountain is 3,615 feet, all being on the northern Cohutta Mountain. The two highest summits and the general aspect of the range are shown in Plate XXXIV-A. In the south part of Cohutta Mountains the heights are decidedly less, the highest being about 2,800 feet, at which altitude there are four peaks. Fort Mountain, the west end of this group, is 2,832 feet high and stands boldly up from the Appalachian Valley. Cold Spring Mountain, 2,700 feet, rises from the Valley almost as steeply, and forms the south end of this group.

The slopes required by these differences in height are practically everywhere steep. Rock summits are rare, however, and only here and there do ledges stand out from the slopes in sufficient size to receive names or to affect the general appearance of the mountains. One group of more moderate slopes is seen near the crests of the mountains and especially in their southern third, where broad rounded summits are fairly common and have the aspect of a plateau in a few

cases. Chief of these is seen on the southern of the Cohutta Mountains, where a definite plateau, including Fort Mountain, stands in the vicinity of 2,600 feet above sea, with uniform summits and shallow, hanging valleys.

There are many comprehensive views from the highest points, such as Cowpen and Big Bald mountains, from which the view is not obstructed by other points of equal height. Other views fully as interesting are seen from Grassy Mountain at the north and Cohutta and Fort mountains at the south, which command the entire width of the Valley spread like a floor far below them. The name of Fort Mountain is derived from the ruins of an ancient building, which is supposed to have been a fort erected there on account of this commanding position. Views are also numerous from the natural open spaces, which are usually grassy or covered with low bushes and stunted trees. Such names as Grassy Mountain and Big Bald Mountain are given on account of this feature.

Drainage. The streams of the Cohutta Mountains consist of the headwater branches of various streams, all of them tributaries of Coosawattee River. The most important of these streams is Jacks River, which cuts the Mountains almost free from the Blue Ridge and forms the boundary of the two for 14 miles.

CROSS RANGES

General plan. There are three important ranges in Georgia which extend northwest across the Highland from its main backbone. The western of these forms a portion of the divide of the Mississippi basin and is part of the Blue Ridge. The two other cross ranges are equally prominent, if not more so, but they form only minor divides in the Mississippi system. Only the Blue Ridge has a name which is applied to its whole extent, and there are no suitable terms in use for the others. The three ranges, including the Blue Ridge, are about equally distant from each other and average about 12 miles apart.

Central Range. The central Cross Range follows the divide between Toccoa and Nottely rivers and has an average northwest trend with only a few diversions of importance. The Range is cut down to the plateau level along the Murphy marble belt, in a manner identical with the pass at Blue Ridge on the other side of Toccoa River, but is continued farther north in Tennessee. This Cross Range is notched more deeply than the Blue Ridge at the heads of the large creeks, and the parts between gaps appear more as short ridges extending northeastward across the general trend of the Range. This peculiarity is more plain in the lower northwestern part of the Range. Good instances of this are Wilscot Mountain and the ridge that includes Poindexter Knob.

The highest part of the Range extends from Blood Mountain on the Blue Ridge to and including Duncan Ridge, practically all being above 3,000 feet. Northwest of Duncan Ridge only a few high peaks are above 3,000 feet, and there are two deep gaps, between 2,200 and

2,400 feet, associated with the Hiwassee Plateau. Two gaps at the heads of Papermill and Rapier creeks, short tributaries of Nottely River, between 1,800 and 1,900 feet from parts of the great valley along the Murphy marble.

The detailed forms of this Range are like those of the Blue Ridge, and there is a marked tendency to a rounded form, with a few ridges like Wilscot Mountain. The common, rather rounded tops are replaced here and there by sharp cones, good examples of which are Coosa Bald in the high part of the Range and Sharptop Mountain in the lower northwest part. There are numerous remnants of a high plateau at heights above 3,100 feet, which belong to the same system as those on the Blue Ridge, and are found on the south side of the Cross Range around the head of Toccoa River. All parts of the Range, the spurs as well as the crest, are dotted with rounded tops at all altitudes, and the traveller in the Range, no matter what his course may be, is obliged to go either up or down.

The principal peaks in this Range beginning near the Blue Ridge are as follows:

Slaughter Mountain	4,370 feet
Wildcat Knob	4,018 feet
Coosa Bald	4,287 feet
Fleming Knob	3,800 feet
4 peaks on Duncan Ridge	3,500 feet or more
Payne Mountain	3,242 feet
Wilscot Mountain, 3 peaks	3,031, 3,201, 3,151 feet
Sharptop Mountain	2,803 feet
5 unnamed points	2,500–2,600 feet
Poindexter Knob	2,500 feet
Watson Mountain, 1 mile south of the N. C. boundary	2,769 feet

Eastern Range. The eastern of the Cross Ranges closely resembles the Central Range but is shorter. It forms the divide between Hiwassee and Nottely rivers, and it ends in North Carolina 3 miles north of the State boundary. Its total length is 16 miles, and its general course is much more steadily northwest than those of of the other Cross Ranges. This Range, however, has an important arm stretching 10 miles from the main body northward between Brasstown Creek and Hiwassee River, leaving the main Range at Brasstown Bald, 4 miles nearly north of the Blue Ridge.

The highest parts of this Range are near the Blue Ridge, and Brasstown Bald, where the two arms of the Range unite, is the highest point in the Georgia Highland. Practically all of the Range is above 3,000 feet as far as Cedarcliff and Gumlog mountains, each about 3 miles from the State boundary. North of these mountains there are deep gaps between 2,100 and 2,200 feet above sea, which are parts of the Hiwassee Plateau. The Range rises again to the 3,000-foot level in Rocky Top just south of the boundary. Another deep pass is found in Brasstown Gap, 2,224 feet, at the head of Brasstown Creek. This gap is occupied by the State road between the towns of Hiwassee, Young Harris, and Blairsville, each of which is situated in a separate section of the Hiwassee Plateau. The detailed forms found in this

Cross Range differ little from those of the other ranges. There are here, however, more of the easterly-trending ridges and few or none of the high plateaus. The rounded shapes which are so common in the other ranges are equally so in this, and even the east-west mountains are made up of chains of small peaks.

The highest points of this Range beginning with Jacks Knob on the Blue Ridge are given in the following table:

Brasstown Bald	4,867 feet
Unnamed peak	4,586 feet
Grassy Knob	4,400 feet
Chimney top	4,229 feet
Buzzards Roost	4,653 feet
Little Bald	4,473 feet
Wolfpen Ridge	4,251 feet
Double Knob	4,052 feet

This group has a continuous length of six miles above 4,000 feet and is the longest tract of this kind in Georgia. Northwest of this high group stand the following peaks:

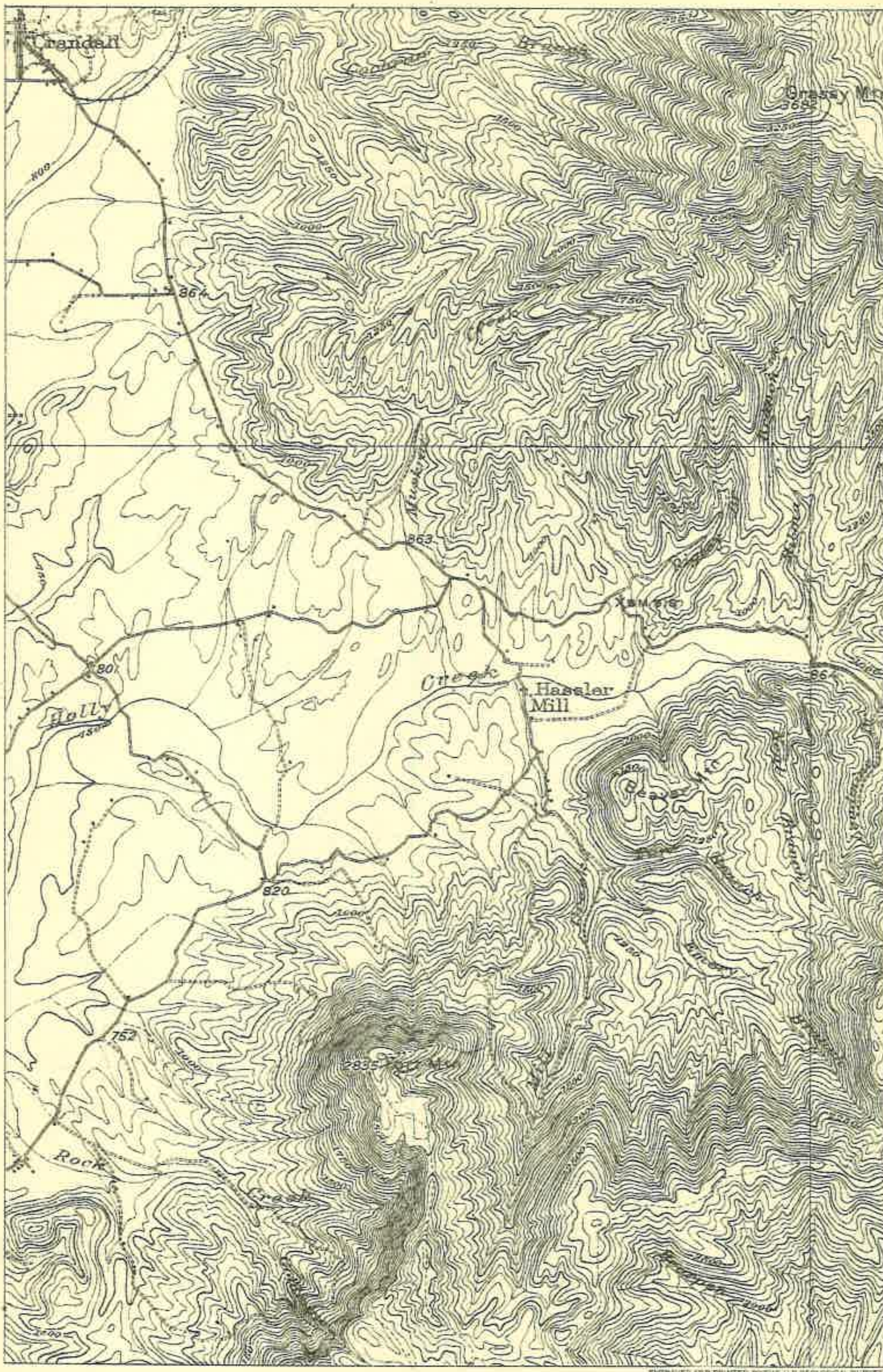
Blue Rock	3,340 feet
Ivylog Mountain	3,250 feet
Gumlog Mountain	3,743 feet
Rocky Top	3,060 feet
Sheep Knob (in N. C.)	2,950 feet
Spaniard Knob	3,860 feet
Round Knob	3,492 feet
Rocky Mountain	3,713 feet
Cedarcliff Mountain	3,391 feet
Davy Mountain (in N. C.)	2,958 feet

DUCKTOWN PLATEAU

Position and limits. The Ducktown Plateau lies in the western part of the Highland and occupies a great amphitheater between the mountains which form the divide of Toccoa River. At the southwest it is connected with the Dahlonega Plateau through the narrow Ellijay Valley, and two similar valleys on the northeast connect it with the plateau of Hiwassee and Nottely rivers. The Ducktown Plateau is 10 miles wide along the State line, mainly along the Tennessee border, and barely touches North Carolina. The Plateau is 20 miles long from northwest to southeast, 5 miles of this being in Tennessee.

The Plateau is limited on nearly all sides by mountain slopes; these mountains are spurs of the Blue Ridge southwest of the Plateau, as shown in Plate XXXIV-B, and of the central cross Range northeast of it. The spurs close in toward each other toward the head of Toccoa River and finally shut out the Plateau. Downstream in Tennessee the mountains shut in again, and the River escapes through a narrow gorge, the rugged nature of which is seen in Plate XXXIII-B.

Where the mountains are well developed there is no uncertainty about the boundary of the Plateau, for the slope of the ground changes there rather abruptly. In the southeast and southwest parts of the Plateau, however, there are many remnants of an older and higher



ENGRAVED AND PRINTED BY THE U.S.GEOLOGICAL SURVEY

BORDER OF THE VALLEY AND THE HIGHLAND NEAR CRANDALL

Scale $\frac{1}{62,500}$

Part of the Cohutta sheet

0 ½ 1 2 3 Miles

Contour interval 50 feet

Datum is mean sea level

plateau than the Ducktown, which stand above 2,000 feet in height. Between the two plateaus the boundary is less plain and must be drawn largely by means of their altitudes, since their forms are alike. The difference in heights is usually between 200 and 400 feet and higher plateau remnants are excluded from the Ducktown Plateau, because they are connected with and belong to the Hiwassee Plateau.

Plan. The general outline of the Ducktown Plateau is remarkably like that of an oak leaf, the various tips lying upstream on the tributaries of Toccoa River, and the stem of the leaf being downstream in Tennessee. The axis or main stem of the leaf is northwest and southeast with the River, and the tips of the leaf are arranged nearly at right angles to it. The groups of narrow valleys which connect this basin with Ellijay Valley on the southwest and with the Nottely basin on the northeast extend nearly straight across the three basins, as is shown in part on the map, Plate XXXII-A. These valleys have the most definite system of any in the Highland and contrast strongly with the plan of all of the other streams. This axis of parallel drainage has lowered the principal ranges down to the Plateau levels and formed a highly important avenue for railroads and roads through the Highland. Its close association with the Murphy marble and associated slates has already been mentioned. Elsewhere the valleys and ridges fork like the branches of a tree, and from this plan results the very irregular outline of the Plateau.

Topographic forms. The surface of the Ducktown Plateau is everywhere rounded and its summits are between 1,600 and 1,800 feet above sea. Straight lines or profiles are nowhere found, except in the cross valley above mentioned, and the roundness of the surface, as shown in Plate XXXVI-B, is continually impressed on the traveler's mind. The Plateau is trenched by all of the streams. Where Toccoa River passes into Tennessee, the trench is 250 feet deep below the plateau summits, and its steep and rocky character is shown in Plate XXXIII-B. The trench is less and less deep upstream, so that the upper branches flow on the old plateau surface near its margin. The large streams, however, have cut their trenches beyond the Plateau limits and into the mountains.

The typical profile along each ridge is a series of rounded summits or domes separated by shallow saddles. These descend in average height very slowly from the Plateau margin toward its middle, but end abruptly at the streams. The cross profiles are similar on the top of each ridge to the lengthwise profiles, but the curve steepens rapidly into the valleys and even faster into the trenches, where they are present. Thus a slope which is nearly flat on top of the ridge passes laterally to one of 30 degrees in the trenches, with here and there rocky slopes which are even steeper. The opposite curve is shown around the Plateau margins where its rolling hills yield to the mountain slopes. The total change is great, but it seldom requires more than one-fourth of a mile.

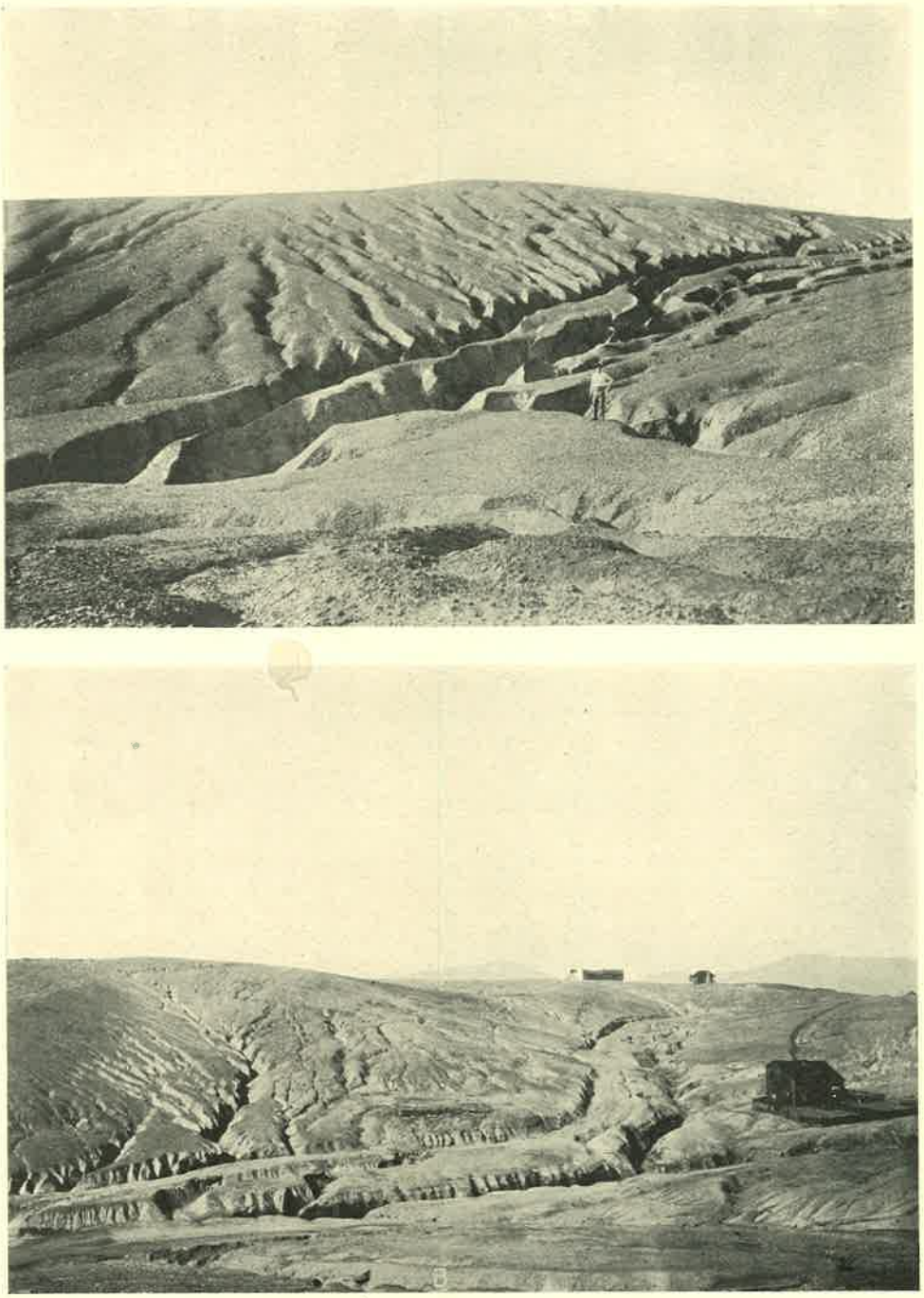
The Plateau, as has been stated, was formed by long continued decomposition of the surface rocks to soils and their removal through the streams. This naturally is most complete near the streams, while between them there are some unimportant tracts not reduced to the Plateau. Another feature in which the completeness of erosion is shown is the depth of the soil. The rocks are decomposed on the older upper surfaces of the Plateau, to depths from 5 to 60 feet, and rock exposures are rare in such situations. Plate XXXVI shows the depth of the soil as exposed in recent gullies. In the newer valleys and the deep trenches erosion has cut away most of the soil cover, and bedrock outcrops in thousands of places. This characteristic, together with the steepness of the slopes, concentrates travel and farming on the hilltops, especially in the northern part of the basin, where the trenches are deepest. Blue Ridge, the second largest town in the Highland, is situated where Ellijay Valley joins the smooth margin of the Ducktown Plateau. The ease of traffic and of town building at that point is strongly in contrast with the surroundings of Copper Hill, which is deep in the trench of Toccoa River at the boundary of Tennessee.

HIWASSEE PLATEAU

Position and limits. The Hiwassee Plateau lies in the northern part of the Highland along Hiwassee River and its tributaries, Nottely River and Brasstown Creek. The portions of it seen in Georgia are intermountain parts of a large plateau which is more widely developed in North Carolina and with which the Georgia parts unite. The features shown by this plateau in Georgia are the same as those exhibited in the Ducktown Plateau, except that they are in the valleys of three streams instead of one. The Hiwassee Plateau is usually from 400 to 500 feet higher than the Ducktown Plateau, and parts of the upper plateau are found around the margins of the Ducktown Plateau. Except for the differences in altitude the individual features of the Hiwassee Plateau are about the same as those of the Ducktown. This is natural because each plateau represents the work done by the same factors (the streams and processes of decomposition) upon the same sets of rocks. Individual formations reach directly across from one plateau to the other and also from one part of the Hiwassee Plateau into other parts.

The three sections of the Hiwassee Plateau in Georgia follow the northwest trend of the main streams and each section is symmetrically disposed along its particular stream. There are isolated areas of higher ground not reduced to the plateau level, which are most numerous at the north and in the Nottely section. Typical of these are Kelley and Youngs mountains, about in the middle of the Nottely basin.

The limits of this Plateau are set where the gentle plateau top rises rather sharply into the mountain slopes, usually around 2,100 feet. The outline of each section of the Plateau is very crooked, and each has the leaflike form shown in the Ducktown Plateau.



Photographs by F. B. Laney.

GULLIED HILLSIDES NEAR DUCKTOWN, TENN.

Topographic forms. The details of form in this Plateau are the same as those of the Ducktown Plateau and consist of gently-rounded hilltops, with narrow valleys along the streams. The valleys are shallow and smooth around the Plateau margin, but elsewhere they are trenches of various depths along the streams. The trenches are from 100 to 400 feet deep in Georgia and are deepest on the Nottely near the State boundary. This stream is barely above 1,600 feet where it leaves Georgia, while the Hiwassee is just under 1,800 feet at the boundary.

The Plateau extends up Nottely River until it is only two miles from the Blue Ridge and the reduction to the Plateau grade throughout its length was remarkably complete. It is more so than on the upper Hiwassee, which is the main stream where the Plateau is decidedly narrow as is seen in Plate XXXI-A.

The principal towns of the Hiwassee Plateau are situated on its smooth inner margin. One is in each section, including Hiwassee, Young Harris, and Blairsville. As the Plateau becomes more and more dissected toward the north, the roads and settlements tend to keep to the smooth upland portions. This is most plain in the lower part of the Nottely basin, where the trenching produced minor valleys in the Plateau at the Ducktown Plateau level, which were in turn still farther trenched below that level.

Drainage. The drainage of the Hiwassee Plateau is accomplished by a variety of rivers which do not differ materially except in size; all are parts of Hiwassee River, and each is symmetrically placed in its basin. Hiwassee River drains the northeast part of the Plateau, Nottely River drains its southwest part, and Brasstown Creek its central and smallest part. The principal branch of the Hiwassee, besides the two already mentioned, is Hightower Creek which drains part of the western slope of the Blue Ridge. Nottely River is joined from the east by Town and Ivylog creeks and from the east by Young Cane Creek.

The stream grades in the Hiwassee Plateau are fairly steep but do not compare in this particular with those south of the Blue Ridge. The margins of the Plateau next to the mountains are about 2,100 feet above sea, and outside of them the streams rapidly increase in grade. Within the Plateau, however, they promptly flatten out to grades which are moderate. Nottely River, for instance, descends 500 feet in 16 miles, not counting the curves. The grades are very similar on the three principal streams, and those of the minor streams are nearly identical with each other. These grades are low and uniform, when the mountainous character of the region is considered. They are nowhere concentrated into prominent falls, although small falls and rapids are common. The amount of power developed by streams with these grades should be considerable, because the rainfall is heavy and the volume of the streams is large in proportion to their basins. The very steadiness of the grade, however, renders it difficult to utilize this fall to advantage.

LITTLE TENNESSEE PLATEAU

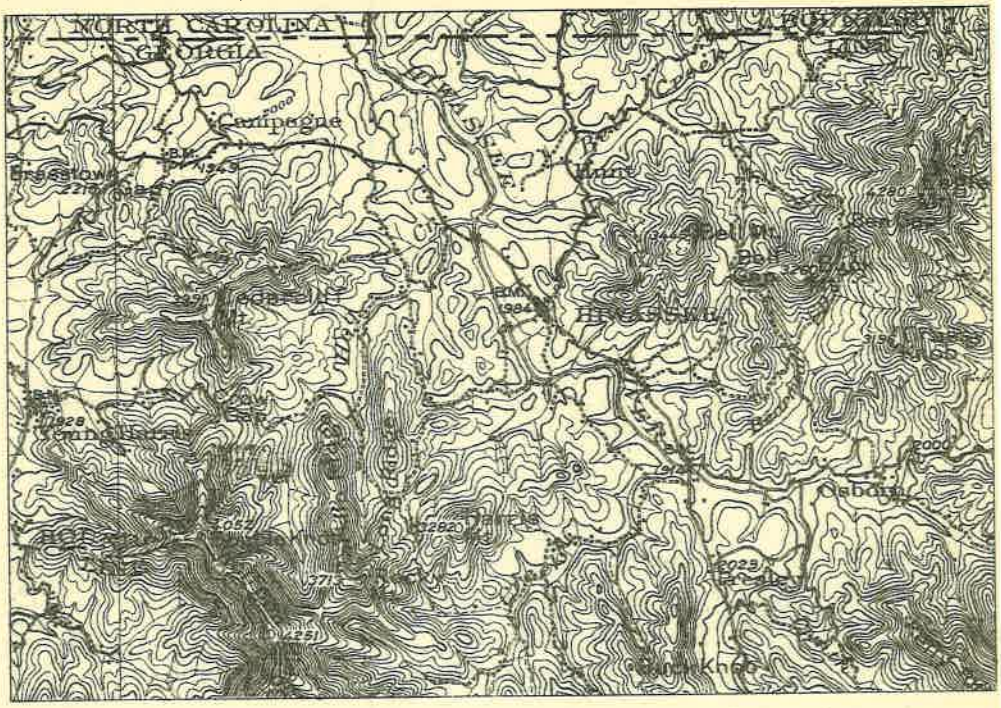
Positions and limits. This Plateau is principally developed in the basin of Little Tennessee River, the head of which lies in Georgia and is more and more extensive downstream in North Carolina. The chief part of the plateau in Georgia is about 6 miles long from north to south, and numerous arms extend from it into the mountains. One of these branches reaches through Rabun Gap into the basin of Chattooga River; whence it extends also into the basins of the Tallulah and the Chattahoochee. None of these plateau sections is as well preserved as that on the Little Tennessee, and none is important enough to require a separate name. They are, therefore, included in the description under Little Tennessee Plateau, because they are continuous and stand at the same height, about 2,100 feet above sea level.

The southern boundary of this Plateau in the Tallulah and Soque basins is marked by the descent to the Dahlonega Plateau, which is strongly developed in those basins at heights of 1,600 or 1,700 feet. Above this surface the Little Tennessee Plateau rises about 500 feet, and the boundary is fairly distinct. The other boundaries of the Plateau are along its margin against the mountains, and are like similar boundaries of the other plateaus. The extension of this Plateau directly across the main backbone of the Blue Ridge is one of the most important features of the Highland, and the position of the watershed is scarcely noticeable.

There are two valley belts in which this plateau is found—one which runs nearly north and south along the main axis of Little Tennessee River and the other trending southwestward across the headwaters of the Little Tennessee, Tallulah and Soque. The two belts intersect in the upper part of the Little Tennessee basin about three miles north of Rabun Gap.

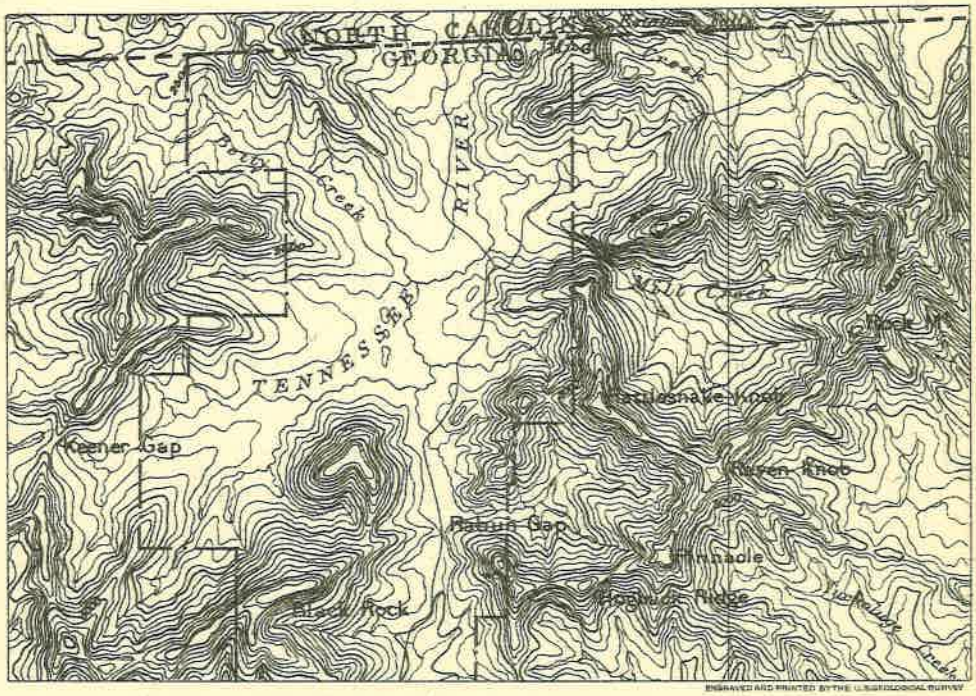
A third valley with an exceptional east-west course crosses the lower half of Timpson Creek in the Chattooga and Tallulah basins, This was reduced to the level of the Plateau, thus making a narrow connection between its various sections. This was so natural a line of travel that one of the earliest roads between the border settlements ran along it across the Tugaloo basin, thence over the Blue Ridge and down the Hiwassee.

Topographic forms. The forms of the remnants of this Plateau differ in almost no respect from those of the other plateaus, and its higher surfaces are smoothly rolling. Near their headwaters the large streams flow in shallow trenches which rapidly deepen downstream, the only exception being the Little Tennessee, shown in Plate XXXVIII-B. In its basin the streams now flow directly on the floor of the Plateau and do not lie in trenches until the River has flowed for 6 or 8 miles into North Carolina. The trenching is greatest in the lower part of the Chattooga, Tallulah, and Soque basins, where the streams have cut down about 500 feet to the level of the Dahlonega Plateau. The contrast between these rivers and the Little Tennessee is very great, but otherwise the description of individual forms given for the other plateaus applies well to this one.



A. HIWASSEE PLATEAU AND SURROUNDING MOUNTAINS NEAR HIWASSEE

Part of the
Dahlonega sheet



B. LITTLE TENNESSEE PLATEAU AND RABUN GAP IN THE BLUE RIDGE

Part of the
Walhalla sheet

Scale $\frac{1}{125000}$

1 ½ 0 1 2 3 4 5 Miles

Contour interval 100 feet

Datum is mean sea level

The reduction of the Blue Ridge backbone to the valley level and the extension of the Plateau into the southward-flowing streams is a very rare feature. A plateau at this height, 2,100 feet, moreover, is not elsewhere known south of the Blue Ridge, and its presence indicates that originally this district was tributary to the Tennessee basin. The character of Rabun Gap itself is such as to indicate that formerly an important stream flowed through it, for the rocks which occupy it are very hard and could not have been cut completely down by the present weak headwaters. The streams flowing south from the Blue Ridge are now cutting their channels with far greater speed than is the Tennessee, and have long done so. It is, therefore, reasonable to suppose that some of the headwaters of the Tennessee were captured and diverted by the swifter and more powerful streams which ran off to the south.

The depression formed by the north-south line of plateaus is of great importance, for here the railroad and highway pass the Blue Ridge backbone in Rabun Gap at very low grades and low altitudes. This is nowhere possible in North Carolina, and in Georgia it can be done elsewhere only at the head of Ellijay Valley, which is nearly at the west margin of the Highland. Where the north-south valley intersects the east-west one, two miles south of Rabun Gap, is situated Clayton, the county seat of Rabun County. The town is thus situated in two natural lines of travel—one now occupied by a railroad and both by main wagon roads. Almost 200 years ago the end of the road from Augusta was at Tugalo, now Fort Madison on Tugaloo River. A rough track led north through Rabun Gap to the scattered settlements on the Little Tennessee basin. Through the Gap the Little Tennessee valley was settled and its traffic flowed, unhindered by the height of the mountains. From far distant farms in North Carolina the mountaineers drove their herds of cattle to lowland markets, and brought back in their wagons the precious loads of sugar and salt.

Drainage. The streams which drain this Plateau are more diverse than those of any other plateau in the Highland. The Little Tennessee flows northward and is part of the Mississippi basin, the Tallulah and Chattooga flow through the Tugaloo direct to the Atlantic, and the Soque and Chattahoochee flow southwest to the Gulf.

All are headwater streams, and few are more than 6 or 8 miles long, except the Tallulah, which flows between plateau remnants for about 14 miles. All the rivers have numerous tributary creeks but none of particular significance except those in the valleys passing through Clayton.

The stream grades here are steep, except on the floor of the Little Tennessee basin, and rapids and waterfalls are numerous in the surrounding mountains. Eastatoa Falls, on an eastern tributary of the Little Tennessee, is the largest and best known, except Tallulah Falls. Tallulah River is the only stream whose volume is sufficient to permit the steep grades of the streams to be utilized. The recent development on this stream include three dams above and one be-

low Tallulah Falls, and make complete use of its power. The three upper dams are in the narrow valley which is an arm of the Dahlonega Plateau, reaching into the Highland. The lower dam is in the gorge below the plateau surface, which begins at Tallulah Falls and is 700 feet deep. This gorge is pictured in Plate XXX-B, and the upper (Burton) reservoir in Plate XXXVIII-A. In Plate I is shown the principal part of Tallulah Falls in its original condition.

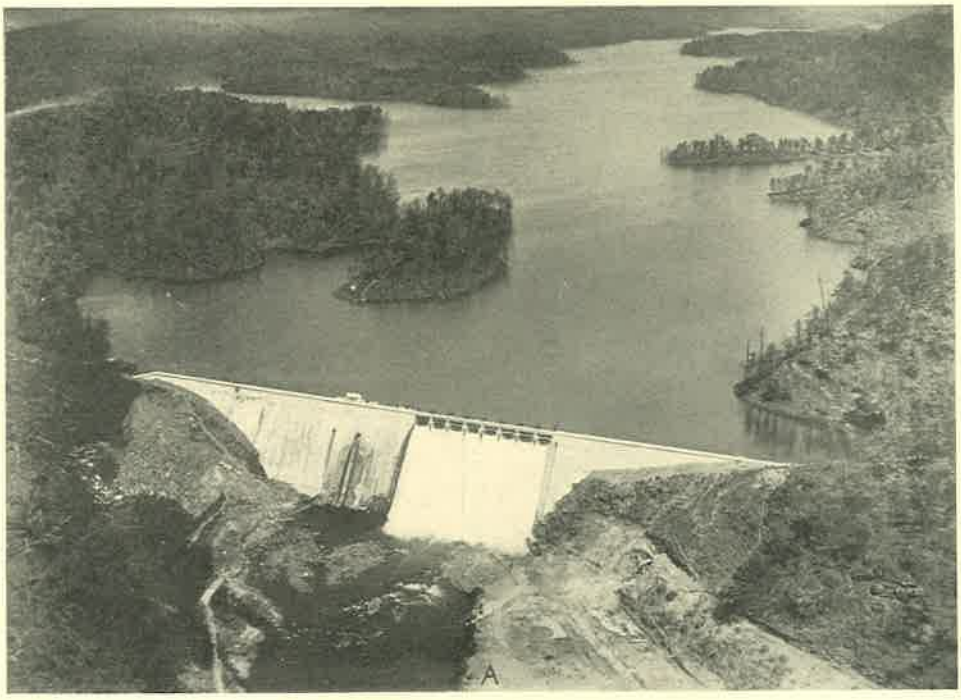
GEOLOGY

GROUPS OF ROCKS

The rocks of the Highland are almost entirely crystalline—that is, the particles of which they are composed have crystal outlines and are not worn fragments such as are seen in the ordinary sands and muds. A few of the rocks in the extreme western part of the Highland, especially the conglomerates, are made up of fragments of minerals, chiefly feldspar and quartz. Elsewhere, however, rocks of this composition as well as others have been crushed and altered during movements in the earth, so that the original fragments are now rarely seen. As they now stand, the rocks of the Highland include marble, slate, phyllite, schist, quartzite, graywacke, conglomerate, and gneiss. All of these were originally fragmental or sedimentary rocks. In addition, there are large masses of granite, of gneiss derived from granite by pressure, of diorite and gabbro, and schists and gneisses derived from them. The granites and granite-gneisses are characterized by a large amount of mica, particularly biotite, while the gabbros and diorites and their gneisses are notable for the amount of hornblende which they contain. The granites, diorites, and gabbros were formed in a fluid condition under intense heat in the depths of the earth. The names and ages of the Highland rocks are shown on the Table of formations.

The marbles are found in a narrow belt in the Ellijay and Murphy valleys. Usually the belt is single, narrow and broken, but in places there are two belts, parallel and close together. It is called the Murphy marble on account of its strong development near Murphy, North Carolina. The ready solution of this marble is the cause of the lowering of these valleys and of their continuity across the Highland. The slates and slaty formations closely follow the marble in a belt 1 to 3 miles wide, and extend southwestward where the marble is locally absent. Slates are also found, but in less volume, westward through the Big Frog and Cohutta mountains, but southeastward there are none more than 3 miles from the Murphy marble.

Conglomerates, quartzites and similar rocks interbedded with layers of slate and phyllite make up nearly all of the western part of the mountains, including the Big Frog and Cohutta ranges. Conglomerate is very rare southeast of the Murphy marble line, but here and there small bodies are found which prove the sedimentary nature of the graywacke and gneiss in which they occur. Graywacke of this sort forms a belt 1 to 3 miles wide southeast of the marble.



Photographs by U. S. Army Air Service (A) and C. W. Hayes (B).

A. BURTON RESERVOIR ON TALLULAH RIVER, LOOKING NEARLY NORTH.
B. HEAD OF LITTLE TENNESSEE RIVER, LOOKING NORTHEAST FROM KEENER GAP.

The Highland is underlain mainly by gneisses of various kinds, and a belt 12 to 18 miles wide joins the graywacke on the southeast. The gneiss consists mainly of massive beds alternating with numerous layers of schist, all characterized by much biotite and muscovite and by minerals like garnet and staurolite. Southeast of this belt lies a great triangular area in which hornblende-gneiss, diorite and granite are common. This area extends westward along the State boundary from the corner of the State to Hiwassee River. It narrows southwestward and passes out of the Highland because the formations run in an average southwest course, while the margin of the Highland bears decidedly more toward the west. The individual bodies of each formation are long and narrow, sometimes to an extraordinary degree and are locally twisted by movements of the earth into intricate curves and angles. The granites occupy the least area of any of the formations and in only a few places cross to the north side of the Blue Ridge. They form many oval areas or belts which are much wider in proportion to their length than are the belts of hornblende gneiss.

AGES OF FORMATIONS

The youngest formations in the Highland are found in or near the Murphy marble valleys, and are all of early Cambrian age. Successively older rocks are found northwestward from this, in the order shown in the table of formations. Nearly all of them are concentrated in a belt from 1 to 3 miles wide near the Murphy marble, except the Great Smoky formation. The latter occupies a belt 20 miles wide and underlies most of the western group of mountains. The graywacke belt southeast of the marble belt is formed by the Great Smoky formation, here coming up nearly on edge from beneath the general slate and marble mass.

The various gneisses and most of the granites are of still earlier or pre-Cambrian age. The several forms of biotite gneiss, known as Carolina gneiss, are the oldest, and are followed in order by the group of diorites, gabbros, and hornblende gneisses. The youngest of the pre-Cambrian rocks are the bodies of granite, which have been much altered into gneisses. Still other and much younger granites are found in the plateaus of the Piedmont, but only a few small bodies of it are now known in the Highland.

Associated in origin with the granites are the numerous pegmatites, which are most numerous. They are of substantially the same composition as the granites, but are very much coarser, and crystals of individual minerals are occasionally found as much as 1 foot in length. These are the source of numerous rare minerals and of the mica which is so well known in commerce.

Still younger rocks are the quartz veins which are so generally distributed throughout the Highland. They are largest and most numerous in the southeast part of the Highland in the various gneisses, but they are also found in all of the formations except the Murphy marble. They range in size from small lenses of the size of the hand to veins 5 or 6 feet thick and a mile or more long. The more continuous bodies are gold-bearing and are the source of some of the auriferous

gravels which have been mined for many years on both sides of the Blue Ridge. Where these veins are associated with bodies of granite and hornblende gneiss the gold content appears to be greatest. This region was the scene of the earliest gold mining in the United States, and the gravels in the vicinity of Dahlonega near the south foot of the Blue Ridge are still being washed from time to time.

STRUCTURE

The most definite structural feature in the Highland is the long, sharp syncline or basin in which are found the Murphy marble and the young formations. This basin consists of several minor folds, but is more than usually simple for this part of the Appalachian Mountains. The axis of the basin enters the State along Nottely River with a southwestward course and curves more and more to the south down Ellijay River and through the Coosawattee basin. In this basin it continues to curve close to the border of the Highland until it runs southeastward across the divide and into the basin of Etowah River. There it holds the great marble deposits in the vicinity of Tate, Nelson, and Ball Ground.

Both west and east of this basin there are general areas of uplift. In the Big Frog and Cohutta mountains the oldest formations of the Cambrian are exposed, and a general zone of uplift passes through them into the Ducktown copper region of Tennessee. The uplift is about 8 miles distant from the Murphy marble syncline and nearly parallel to it on the northwest. West of this is a rather shallow trough in the Cohutta and Big Frog mountains.

Rocks northwest of the main syncline dip as a rule to the southeast at angles from 20 to 80°. Southeast of the main syncline the Cambrian rocks are sharply turned up in the narrow graywacke belt, and farther southeast only formations of pre-Cambrian age now remain at the surface. These are tremendously folded and complicated, as can readily be determined where the different parts are unlike, but it is not possible yet to outline most of the structures. The region is one of uplift, however, and of very great uplift. This elevated character extends southeastward, including the Dahlonega Plateau of the Piedmont as far as its southeast margin at the divide between Chattahoochee River and the smaller streams flowing directly to the Atlantic. At this situation, from 20 to 30 miles southeast of the Blue Ridge, a long narrow belt of schist and marble marks a deep syncline which corresponds roughly to that of the Murphy marble. Northeastward this steadily converges on the Highland and enters it in South Carolina. The uplifted character of the great mass between the two synclines is doubtless due in part to the several intrusions of granite which it has suffered, but the individual lines of greatest uplift can not yet be laid upon the map. This mass had been raised higher than any part of Georgia, when the great mountain-building epoch was done, and from the beginning divided the Atlantic drainage from that of the interior of the continent. The Blue Ridge is thus a most ancient mountain range, and its accompanying ancient valley is seen near the Chattahoochee, which closely follows the principal basin in the Piedmont.

The Highland appears to contain few faults, or breaks in the crust of the earth. They are present in at least two important zones, and many more may be as yet undiscovered. The border of the Highland and the Appalachian Valley is marked by a great fault, on which the old Cambrian rocks have been forced westward for miles over younger Ordovician and Silurian rocks. The great contrast between the weak rocks of the Valley and the hard, insoluble rocks of the Highland has caused the abrupt change in the form of the surface there as is shown on the map, Plate XXXV. This fault passes far to the northeast through Tennessee and southwest through Georgia. Another zone of faults appears in association with the Murphy marble belt. These faults, two or three in number, are continuous across the Highland parallel to each other and seldom more than a mile apart. All of the Highland faults have easterly dips, the Highland border fault being rather flat and the marble belt faults being steep.

SOILS

Next to the almost universal presence of soils in the Highland, the most notable thing about them is their depth. Only the scattered ledges and rare cliffs form any obstacle to farming, with here and there small trains of boulders slipping down the steep hillsides or cobblestones in the river bottoms. Small rock fragments and pebbles are numerous in most of the formations but do not handicap the farmer greatly. They are readily picked up or are turned aside by the plow or the hoe. The soils, including the surface and sub-soils, range from 50 feet down to a thin sheet near the ledges.

The deepest soils are found over the areas of Murphy marble, which is deeply dissolved and forms very few outcrops. These soils consist of red clay, with more or less overplaced material washed from the hillsides. Other soils composed almost wholly of red clay are those on the hornblende gneiss, diorite, and gabbro. These are darker red than the limestone clays and not as deep, but still are far deeper than is necessary for farming. The slate formations also are covered with clays, either reddish or dark brown, in which small fragments and chips of slate are numerous. These soils are comparatively shallow and rarely more than 4 or 5 feet deep.

The soils on the other formations in the Highland consists largely of clay, but they also contain more of other materials than the soils already mentioned. The various schists and mica gneisses, for example, contain considerable quartz sand and a great deal of mica in fine scales. These loosen up the soils so that they can absorb more water, but the same factors cause them to drain and wash more readily. Small fragments of schist are especially numerous in the schist soils and in many situations—for instance the old erosion surfaces of the plateaus—form a cover which protects the underlying soils from removal. The granite soils are less important in the Highland than the other soils, on account of their smaller area. They too consist largely of red clay with some mica, but the proportion of quartz sand is large. On the old plateau surfaces the steady reduction of the surface and the removal of the fine clays has left a blanket of the sand and quartz

fragments, which passes gradually downward into a sandy red clay. Many of the coarser gneisses, whose minerals are the same as those of the granite, form similar sandy soils. The poorest and thinnest soils are produced by the Tusquitee and Nottely quartzites, which consist almost wholly of quartz. Ledges are far commoner on these formations than on others in the Highland, and their soils are of no importance for farming.

The traveler in the Highland wonders at the vast numbers of quartz fragments in the soils. These are present in all parts of the Highland and in all formations except the Murphy marble, but are more common toward the southeast in the schists and gneisses. They decompose with extreme slowness and are concentrated on the surface as it is worn down. Gradually they slide down with the soils from the hillsides and wash into the stream channels, and they are present on all slopes where decomposition has proceeded far, as in the various plateaus and intermountain valleys. The farmers keep them picked out of the fields under cultivation, but in those which are abandoned they soon become prominent, as the fine materials and clay are washed down the slopes. A local use has been found for them as material for the smelters at Ducktown, but elsewhere they are only a detriment and are specially objectionable in the roads.

Along all the streams narrow bottom lands are formed which contain the best soils of the region. These are rarely more than a quarter of a mile wide and usually are much less; they are widest and best where the intermountain valleys are widening out into the plateaus. In such situations the streams have swung rather widely from side to side and deposited the soils of the bottom lands. The soils consist of silts from 4 to 6 feet thick resting on a bed of gravel, which lies on the bedrock. These soils are of uniform composition and are made up of the mixed waste from many kinds of formations. Usually in the upper reaches of the large streams the bottom lands are bordered by narrow terraces which are the remnants of former bottom lands.

The chief difficulty which the farmers of the Highland must guard against is the washing of the soils. Except on the bottom lands, terraces, and the flat parts of the plateaus, the slopes are fairly steep, and the rains concentrate readily into rills. Gullies are soon formed unless watched and checked, especially in the micaceous and sandy soils which occupy most of the Highland. A single heavy rain may start a set of gullies which it will take months to repair. The complete system of gullies which forms when no check is applied is seen around Ducktown. There the soils are literally devoured and cast into the streams, which spread them over the bottom lands downstream and destroy the best lands of the region. These gully systems are illustrated in Plate XXXVI. The continual care required to prevent gullying on any farm is an added charge against the farmer's profits. Where farms are abandoned their soils soon go down hill into the streams, unless the undergrowth comes up in time to check the process. This situation is so general and so ever present that it has led to the establishment of the great national forests which cover much of the Highland, in order to protect the headwaters of the streams,

where the washing is greatest on account of the steep slopes and the heavy rains.

The depth of the soils in the Highland has a distinct bearing on mining as well as farming. The principal mineral deposits of the region are the copper deposits on the Ducktown Plateau and the gold deposits on both sides of the Blue Ridge. The copper deposits show at the surface as a gossan of iron ore. This extends down to the depth of the sub-soil, and there is replaced by the rich deposits of black copper ore. These extend downward into the rock formations as far as decomposition has reached, below which they are replaced by the refractory sulphides of copper. The early work of the region was the recovery of the copper from the rich deposits. These were worked out and the mining lagged, until means were found to handle the sulphide ores which were below the level of the soil-making processes. The later smelting of the sulphide ores produced the enormous amount of sulphur gases which have destroyed the vegetation in a considerable area around the smelters. Thus the character of the mining there was directly due to the processes which produced the soils.

The gold deposits along the southern border of the Highland are similarly conditioned by the depth of soil making. The early recoveries of gold were from the stream gravels, into which the heavy bits of gold were washed and concentrated by natural processes. These at first were handled by the pick, shovel and log washer, but later were attacked by powerful streams of water under heavy pressure. These streams washed down not only the old stream gravels but the adjoining deposits of soil which had not been moved far from the parent rock. The latter were found to contain gold and to be well worth handling. Eventually the most profitable portions of these soils were found to be along the contacts of granite and hornblende gneiss. Hydraulic washing along such contacts was developed to a tremendous extent around Dahlonega, just south of the border of the Highland, and this became the headquarters of gold mining before the discovery of the California fields. The hydraulic giants cleaned off the soils and partly decomposed rock to depths as great as 50 or 60 feet. Such cuts were long as well as deep and are illustrated in Plate XXXIII-A. showing the old Barlow cut near Dahlonega.

The downward limit of the rich gold-bearing soils was the bed rock, and the richest portions lay on that. Countless attempts have been made to discover a special mother lode for the gold in the quartz veins, but without success. These veins are gold-bearing and contain very rich pockets in places.

The proportion of values below and above the base of the soil zone is very different, and in most mining operations the profits have ceased when work was begun in the hard rock below the soils. The great open cuts around Dahlonega made by the hydraulic giants testify to the success of the hydraulic method, as do also the miles of ditches built to convey the water to the workings. These ditches are in places 6 or 8 miles long, winding in and out along the hillsides from the upper waters of the streams. If the soil cover had not been so deep the construction of these ditches would have been impossible without prohibitive expense.

The depth of soil in the Highland is also related to public works. The relation has been well understood in connection with the roads, and the deficiencies of the clay roads in wet weather and their virtues in dry weather have long been plain. When the time comes for macadamizing or paving roads, the great variety of ledges which protrude from the soil will be of the utmost value. Suitable material can always be found within a mile, and usually in very much shorter distances. The presence of the deep soils permits road grading at a minimum of expense, except on the steeper mountain slopes where the soils are thinner and ledges are more numerous.

The depth of the soil has less than the usual influence on railroad building in the Highland because the railroads follow the low ground near the streams, where the soils are most completely removed and rock is most common. A given mileage of railroad in the Highland is, therefore, more expensive than in the Appalachian Valley or the Dahlonega Plateau. This would not be true in the upper parts of the river basins north of the Blue Ridge, but thus far no railroads have been built in those localities except on Little Tennessee River. The advantages of the old plateau surface of the Little Tennessee, in this respect, are very pronounced over the small valleys south of the Blue Ridge tributary to Chattooga River.

CLIMATE

The climate of the Georgia Highland has the same characteristics as that of the adjoining highlands in North Carolina and Tennessee. The more southerly position of Georgia, however, and the lower general altitudes there make the Georgia portion of the Appalachian Mountains less cold and humid then the others.

RAINFALL

The Highland is characterized by a large rainfall, which is considerably greater than that of the adjoining Piedmont Upland on the south and markedly more than that of the Appalachian Valley on the west. All of the Highland has 60 inches of rainfall annually, and most of it has more than 65 inches, while the Piedmont and the Valley have 10 inches less. The difference in precipitation is maintained in most parts of the year, but is especially marked during the summer months when thunderstorms are frequent. These storms cross the Appalachian Valley with the prevailing southwest wind, but with little or no rainfall. Upon striking the Highland they increase in intensity, envelop the highest ground, and rainfall ensues. Some of these storms are torrential, and the volume of water is so great and so quickly gathered by the swift streams that often a rain of half an hour's duration will render them impassable.

At such times it is only the great power of the soils to absorb the rain and of the forests to hold it back that prevent the soils from being stripped to bedrock and the country laid waste. Such a result already obtains in the northern part of the Ducktown Plateau in Tennessee and Georgia where the protective cover of vegetation has been killed (see Plate XXXVI.)

The rains of winter are longer and sometimes continue for several days, but they are not as heavy as the summer rains and consequently are easily absorbed by the soil and forest litter. These, too, prevent or retard evaporation, although it is rapid in the cleared fields of the plateaus and small valleys. The summer sun has a tremendous heating power in the clearings in the mountains and plateau margins, and the contrast between such situations and the wooded slopes is very great.

Considerable moisture is also condensed in the summer and fall from the clouds which cover the high ground and from fogs which fill the valley bottoms. The mountains may be covered with clouds during many days at a time, for hundreds or even thousands of feet below their summits, so that a considerable amount of moisture is thus collected. The fogs of the valleys are peculiar phenomena. They gather during the summer months to depths of 100 or 200 feet where the valleys are surrounded by mountains. Occasionally they fill the entire area of the intermountain plateaus, so that the mountains and hills stand above them like islands in a sea. They form during the latter part of each night, perhaps for a week at a time, and usually are dispersed by the sun's rays before nine o'clock. It is a curious fact that these fogs are not formed when bad weather is imminent, so that the morning fog is recognized as the forerunner of a fair day. These fogs cut off the sun's rays for three or four hours and thus materally reduce the evaporation of moisture from the ground. Both the fogs of the valleys and the clouds of the summits are favorable to vegetation, and especially to the grasses. In fact, many of the cleared fields on the mountain sides are better suited to permanent crops like grass than to anything else.

The precipitation in the Highland is nearly all in the form of rain. Snow occasionally falls in late October on the high ground of the Blue Ridge and the Cross Ranges, but it usually does not fall before late January or February on the adjoining Dahlonega Plateau. Some snow usually falls in December on the intermountain plateaus, but rarely remains long on the ground. The high ground above 3,000 feet in altitude affords the only localities where the snow stays long, even in mid-winter. The area of such ground is comparatively small and most of it is on or near the Blue Ridge. The amount of snowfall increases northeastward in Georgia, partly on account of the greater width of the mountain belt and also because of its more northerly position. The same increase continues into North Carolina for the same reasons. In Georgia it is only after exceptional storms or on the very highest ground that the snowfall is heavy enough to become a serious matter, as it is in the more northern states.

The proportion of sunny days is greater in Georgia than it is in more northerly parts of the Appalachian Mountains. The same is true to an even greater extent in the adjoining parts of the Piedmont Upland. This is due partly to the southerly position of Georgia and the greater average power of the sun, and also to the fact that the State is south of the tracks usually followed by the cyclonic storms. These

storms furnish a large part of the rainfall in the northern and central states, but Georgia is far enough south so that their influence is diminished. It is largely on this account that the prevailing winds in this region are from the southwest. They thus represent the indraft toward the centers of the storms, as well as the general eastward flow of the winds in the United States.

TEMPERATURE

The average annual temperature of the Georgia Highland is higher than that of similar tracts in North Carolina. The difference is greater in summer than in winter, partly because the Highland is narrower in Georgia, so that the influence of the warmer plateau and valley belts extends farther into the mountains. The average annual temperature of the Highland is from 52° to 58°, and for the individual mountains is much lower, but few regular observations of it have been made. The coldest ground is in the high mountains, because the temperature invariably is less where the ground is higher. Thus the belts of equal annual temperature follow at about the same height around each mass of high ground. While this relation is known to exist, enough measurements have not been made to place the lines of equal temperature in detail upon the map. The temperature lines for winter are similar in outline to those of the summer, but the line of 50°, for instance, would be decidedly higher up the slopes in summer than in winter. The rigors of the winter climate are distinctly less than they are in North Carolina, and in the valleys the summers are hot enough to deter the inhabitants from great exertions.

The season for growing crops is long and frosts do not come until late. The latter part of October is apt to be frosty on the low ground, and it is certain to be so in the high ground, but freezing weather may not come until January or even February, as the seasons vary. The danger from late frosts in the spring is over in early April for the low ground and by late April for the high ground. The growing season is nearly 200 days long.

FORESTS

The Georgia Highland was originally heavily forested, so that only the rock ledges and a few rocky or grassy peaks were not covered. Considerable tracts have now been wholly cleared for farming, and in an area of a few square miles in the lower part of the Ducktown Plateau the vegetation has been killed or stunted by the fumes from the copper smelters. Most of the clearings for agriculture are in the narrow valleys where the mountains are close, or on the tops of the plateau hills. The narrow strips of bottom land along the streams are nearly all in cultivation, and in the mountains these furnish by a far the greater part of farm land. Fields have been cleared, however, in nearly all parts of the mountains except on the highest peaks. The high plateau at 3,200 feet on Burnt and Amicalola mountains has many farms, and the same is true of portions of Cohutta Mountain which stand at similar heights. The natural balds, or grassy summits

which are rather common in the Highland, are also used as grazing ground as well as the thinner portions of the forests. The character of the mountain clearings is shown in Plate XXXIV-A, a view in the Blue Ridge, which also indicates the large size of the original timber at the height of 3,600 feet above sea level. In fact, the best stands of timber are on the high ground where the moisture and temperature are more favorable, or in hollows on the north sides of the ridges where also they are favorable.

Practically all of the timber cover in the Highland is hard wood. It includes a great preponderance of oaks of various kinds and of chestnut and hickory. These trees grow freely in all parts of the mountains, both high and low. Poplar trees were common in the lower slopes and sheltered coves, as well as cherry and linn. Hard pines are numerous on the lower slopes, especially where they are stony and the soil is thin. The pines seem able to exist in these surroundings better than the larger trees above mentioned, and they are accompanied by smaller varieties of oaks.

The high grade timber has long since been taken out and exported, except from remote tracts at the headwaters of the rivers, the largest being at the head of the Toccoa basin. In the valleys and plateaus little remains except wood lots and low grade timber. Much merchantable timber still remains in the Highland, but the difficulties of marketing it over the steep roads and long hauls to the railroad absorb most of the profits.

POPULATION

DISTRIBUTION

The Georgia Highland is a thinly settled region, like the rest of the Appalachian Mountains. The population as a whole is thinner than that of the adjoining Dahlonega Plateau and far less dense than that of the Appalachian Valley. Most of the Highland was in possession of the Indians long after the lower countries were settled, and some of the fruits of this are seen in the hundreds of Indian names.

The distribution of population follows very definite laws. Much the greater part of it—perhaps more than nine-tenths—is near the plateau margins, with strings of farms extending into the mountains up the minor valley floors. The opposite is the case in the lower parts of the plateaus, where the streams flow in deep trenches and the population is chiefly on the hilltops. These laws of distribution apply to the farming element, which includes most of the population of the Highland.

Union County, which is about the same as the basin of Nottely River, is typical of this general situation. Blairsville, the county seat, is situated where the narrow upper valley widens out into a plateau. This is nearly in the center of the County and is a town of 230 inhabitants with local interests. Of similar nature, but smaller, is Hiwassee, the county seat of Towns County, which takes in the basin of Hiwassee River. The character of this plateau margin or inter-

mountain valley, which is typical of the valleys north of the Blue Ridge, is seen in Plate XXXI-A. Young Harris, a town of the same size as Blairsville, has a similar situation on the plateau on Brasstown Creek.

Morganton, the old county seat of Fannin County, has the same kind of a situation, and is in about the center of the river basin. The building of the railroad up Toccoa River and through Ellijay Valley so altered the business and population that the county seat was shifted to the town of Blue Ridge, where the railroad turns southwest out of the Highland. It is joined at Blue Ridge by a line of the Southern Railway extending northeastward. The town of Blue Ridge has grown to a population of 904 inhabitants and for a long time was the largest town in the mountains. Its growth was due to its position near the line of travel up and down Toccoa River and the narrow valley going northeast and southwest through the mountain section. The town is in the narrow gateway through which all traffic must pass, and in which the great barrier of the Blue Ridge is removed

AMOUNT

The railroads have stimulated the growth of towns along their lines, the most important being McCaysville, which is on the Toccoa at the State line, and adjoins Copperhill in Tennessee. This town has grown rapidly to be the largest town in the Highland, and has a population of 2,166. Copperhill is the headquarters of the Ducktown mining district in Tennessee and of a few lesser mines in Georgia. Tallulah Falls is situated at the head of Tallulah gorge, where travel can pass around the gorge at easy grades. The power development there has increased the importance of the town, which formerly was at the end of a branch line of the Southern Railway. The recent extension of this railroad into the Little Tennessee valley has developed several villages along its line and has increased to 677 the population of Clayton, the county seat of Rabun County. This town is at the crossing of two valleys or natural lines of travel, as already explained.

To sum up, the principal centers of population are the towns with special interests, such as McCaysville and Tallulah Falls, those with special advantages of position like Blue Ridge, and the county seats, which are the centers of the agricultural communities and of the legal and political business of the counties.

CHARACTER

The character of the population in the Highland is very uniform, as is customary in farming regions. The people are directly descended from the original Scotch-Irish immigrants, and many of their social customs and ways of farming are those which have been in use for three, four, or even five generations. The country is so rough and so stony and muddy in bad weather that communication and development are hindered, and the long distances to markets, if there were any at all, have rendered farming unprofitable. The farmers have won a living, but not much more, and their principal means of getting ready

money has been to raise live stock and drive it out to the markets or to haul lumber, cross ties, and tanbark to the railroads. These are hard and tedious ways, and the profits are insufficient to attract any but hardy people whose needs are simple.

People of a decidedly different character have come into the region in connection with mining. They have settled at a few points along the railroad from Murphy to Blue Ridge where talc and iron ore were mined and marble quarried, but the principal place is the copper mining district around Copperhill. Here there is a large concentration of people from outside of Georgia and of different customs and origin. In Blue Ridge a considerable element of summer visitors has appeared, attracted by the scenery and healthfulness of the region, and the same element of population has long been present at Tallulah Falls and Clayton.

TRANSPORTATION

RAILROADS

The transportation facilities of the Highland are very limited. The principal railroad is a line of the Louisville & Nashville R. R. between Knoxville, Tenn. and Atlanta, Ga. This comes up Toccoa River in the Ducktown Plateau, and leaves it at Blue Ridge through Ellijay Valley, thence following this depression about parallel to the Highland border and from one to four miles distant.

A branch of the Southern Railway connects with this railroad at Blue Ridge and runs northeastward along the same narrow valley to Murphy in North Carolina and thence to Asheville. The western flank of the Highland is also served by the main line of the Louisville & Nashville R. R. between Knoxville and Atlanta, following the Appalachian Valley two to three miles from the mountain foot. A branch of the Southern Railway enters the Highland at Tallulah Falls, and passes up Tiger and Stekoa creeks to Rabun Gap in the Blue Ridge. Thence it runs down the Little Tennessee valley to Franklin, North Carolina. Around Rabun Gap and northward in the Little Tennessee basin, the railroad runs on the surface of an intermountain plateau, the nature of which is shown in Plate XXXVIII-B. A second branch of the Southern Railway ends where Chattahoochee River comes out of the Highland.

This arrangement of the railroads leaves the great mass of the Highland without any railroad transportation. The tract between these lines is 72 miles long from northeast to southwest and 26 miles wide across its middle. No other through lines can be built across the Highland without great expense, on account of the heavy grades required in crossing the Blue Ridge. Branch lines can readily be extended up the valleys north of the Blue Ridge at moderate cost, especially in the Nottely and Hiwassee basins.

WAGON ROADS

The Highland is well served with wagon roads. Main roads run up and down the principal valleys and pass at their heads through

the lowest gaps in the Blue Ridge. These connect the intermountain valleys with the Dahlonega Plateau south of the Highland and extend northward into the large plateaus in North Carolina and Tennessee. The head of Tallulah River on the south side of the Blue Ridge is the only area which is not connected by a main road with the corresponding stream north of the Blue Ridge (in this case Nantahala River, North Carolina). The pass between them is over 4,000 feet in height, and the headwaters of the Nantahala are uninhabited. Main roads also connect the county seats, of which there is one in each important valley. These roads go through low gaps in the Cross Ranges, most of which are only slightly above 2,000 feet, so that the grades are not very heavy.

There are secondary roads and farm roads in practically every valley of the mountainous parts of the Highland. These run well up to the heads of the streams, as far as the settlements extend, and in many cases go through the gaps in the Blue Ridge and the Cross Ranges. In such positions the roads are steep in their upper portions and are of moderate grades in the lower parts. As the river valleys widen out and the low plateaus begin, the roads tend more and more to leave the streams and traverse the smooth hills of the plateau. This tendency is pronounced in the lower parts of the valleys, where the plateaus are wide and the streams have cut into them deeply. In such situations most of the roads follow the uplands instead of the valleys, because of the steep and rocky nature of the stream trenches. The roads are thus required to go up and down hill a great deal, but the grades are not especially steep or the hills long.

Only three roads have yet been built in the Highland for modern automobile traffic, although others are now being constructed. A main road now partly built runs nearly east and west in the north part of the Highland and connects the county seats, Clayton, Hiwassee, Blairsville, and Blue Ridge. Another partly built road runs north and south through Blairsville, between Murphy, N. C., and Gainesville, in the Piedmont. Paved roads are almost unknown, and the automobile traffic, which is considerable in the plateau sections, must use the ordinary dirt roads. On these roads, fords are numerous and bridges are scarce except where the large streams are crossed. These features are a handicap for travel in automobiles, especially in wet seasons when the dirt roads of the plateaus become muddy and those in the mountains are both muddy and stony. The necessity for fording is often a serious matter, on account of the rapid rise of the streams during heavy rains. Since the roads in the narrow valleys outside of the plateaus cross the streams repeatedly, the amount of fording required in any trip, even one which would be short for an automobile, is very great. The extremely well-watered nature of these mountains becomes in this way a handicap to travel.

THE VALLEY PROVINCE

By Marius R. Campbell

GENERAL DESCRIPTION

The Central Upland and the Highland provinces of Georgia are bounded (as shown in Fig. 4), on the west and north by a great valley which ranges in width from 35 miles on the Tennessee line to approximately 53 miles in the vicinity of Cartersville, and 28 miles where the southern boundary crosses the Georgia-Alabama State line. This feature is called a valley because its general surface, though 600 to 800 feet above sea level, is from 1,000 to 2,000 feet below the summits of the mountains on either side. It is the southern part of the Appalachian Valley, a similar feature, that can be traced from the southern boundary of Tennessee to northern New York, and, in the other direction, from the west line of Georgia to central Alabama, where it passes beneath the sediments belonging to the Coastal Plain of the Gulf of Mexico. In the north this valley consists generally of two parts: a single broad valley on the southeast side; and a number of narrow valleys, separated by equally narrow ridges, on the northwest side. The principal valley on the southeast side is called Kittatinny in New Jersey; Cumberland in Pennsylvania; and Shenandoah in Virginia. Throughout Tennessee, Georgia and Alabama the two-fold division of the province is not so apparent as it is farther northeast, and the entire feature is usually regarded as a single valley whose floor, in places, is flat, as shown in Plate XXXIX, and in other places is diversified by low ridges and shallow valleys trending in general parallel with the mountain fronts on either side. In Tennessee it is known as the Valley of East Tennessee, but in Georgia it will be referred to simply as the "Valley."

The Valley is lower than the mountains, because the rocks underlying it are different from those underlying the mountains; the former being mostly limestone and shale which are easily eroded, whereas the latter are hard and yield but slowly to the action of the weather and the streams. The ridges that diversify the floor of the Valley stand somewhat above the general level, because they are composed of sandstone and sandy shale which are more resistant than the great mass of the adjacent limestone, but not so resistant as the mountain rocks either to the east or the west. As a consequence these ridges are intermediate in height between the valley and the mountains.

The kind of rocks underlying the Valley not only determines the character of the surface, but they also have a decided effect upon the character of the soil, and, in turn, the soil has a marked, but indirect, effect upon the intellectual development and the mode of life of the inhabitants. The soil produced by the decay of limestone is generally a rich, dark loam that furnishes the best farming land of the province; in places, however, it is full of chert or flint nodules that

seriously interfere with the cultivation of grain or cotton, but such lands have been found to be excellently adapted to the raising of fruits and berries. The soil derived from the shale is generally less fertile than that derived from the limestone, unless the shale contains much calcareous (limy) matter, in which case the soil resulting from it may be very well adapted to pasture lands and the raising of crops. The soil produced by the disintegration of sandstone is composed mostly of sand, and, therefore, is light, porous and generally infertile.

As the rocks of the Valley are commonly tilted at high angles, they crop out in bands of variable width parallel in a rude way with the Valley and the fertile soil is found in corresponding bands, alternating with bands of less fertility, or with bands of soil so poor that they do not pay for cultivation. The banded character of the vegetation growing on these lands is reflected in the farm buildings and the general appearance of the country.

The boundaries of the Valley are generally very definitely marked by nature, being the foot of the Cohutta Mountains on the east, as shown on Plate XXXIX-B, the Central Upland on the east and south, and the foot of Lookout Mountain on the northwest. In order that the exact position of these lines may be established on the ground or on some topographic map, they will be described in some detail, beginning on the east side at the northern boundary of the State.

From the Tennessee line as far south as Ramshurst on the Louisville and Nashville Railroad the highland to the east of the Valley is a part of the Highland or mountainous section of the State, the most southerly peak being Cold Spring Mountain, on the county boundary, 4 miles northeast of Ramshurst. The boundary line separating Cohutta Mountains from the Valley is very definite and regular, except that at Hassler Mill, where Holly Creek emerges from the mountains, the plain, as shown on Plate XXXV, extends about 3 miles into the mountains, making a great reentrant angle in the boundary line.

The mountains bordering directly upon the Valley north of Crandall have a height of only 700 or 800 feet above the Valley floor, but south of Crandall they are considerably higher and several of the high peaks are within sight of the Louisville and Nashville Railroad. One of the most pronounced summits, at least it so appears from the railroad, is Grassy Mountain, lying just east of Crandall and about 4 miles from the margin of the Valley. This mountain has an elevation of 3,682 feet above sea level, but Bald Mountain, some 2 miles farther east, is still higher, rising to an elevation of 4,010 feet. These are the highest mountains ordinarily visible from the Valley but they are not so striking as Fort Mountain (Plates XXXIV and XXXIX-B), just south of Hassler Mill, which rises abruptly from the plain to an elevation of 2,835 feet above sea level, or 2,000 feet above the Valley floor.

Fort Mountain is so named because on its summit are the remains of rude stone walls that once evidently constituted a fort of no mean proportions. As the summit area is somewhat higher than the narrow

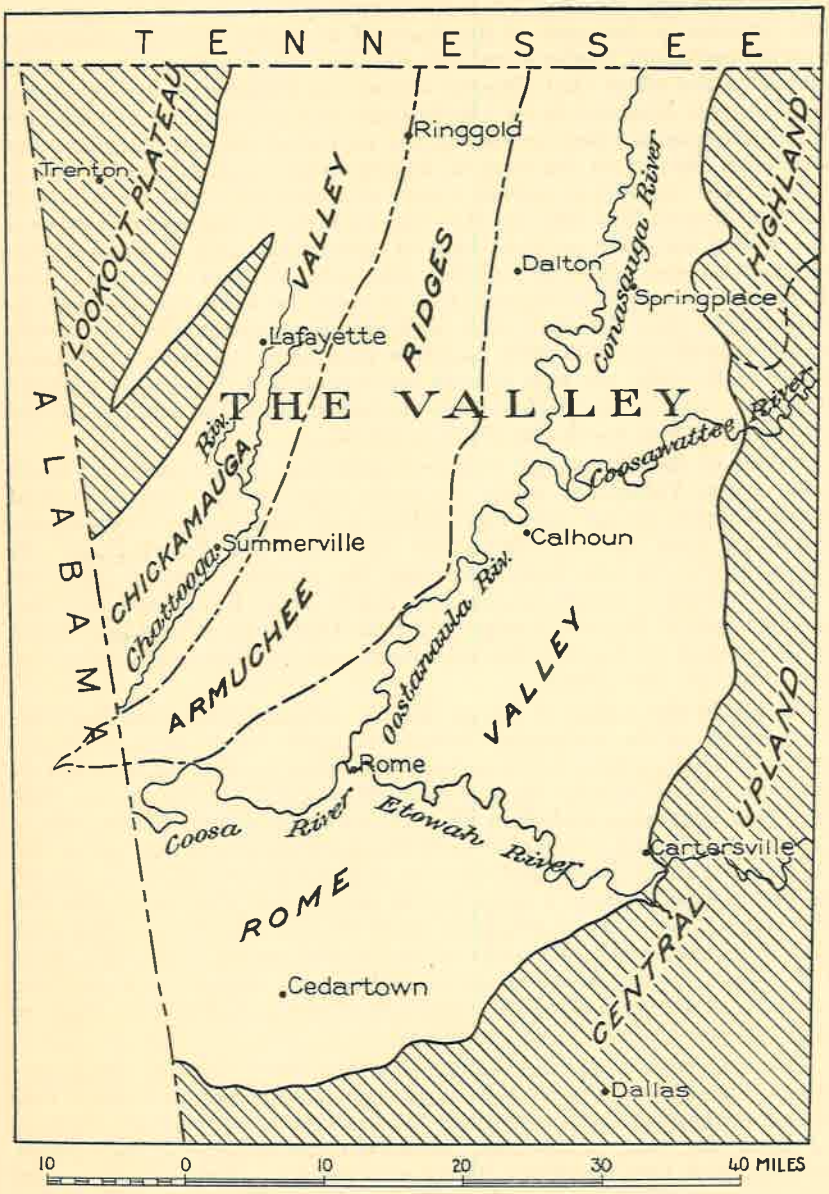


Figure 4. The Valley and the Lookout Plateau.

neck connecting this mountain with the main ridge to the south and as it is bordered on the other sides by nearly vertical cliffs, it affords an admirable site for defense, its only weak point being a very limited supply of water afforded by a small spring near one of the gates. The traveler in this part of the State, if he makes inquiries regarding it, will hear many stories about this old fort. The one most commonly told is to the effect that DeSoto, during his wanderings in this region in 1540, was hemmed in by the Indians and retreated to the summit of this mountain, where he erected the walls that we see today; another attributes the fort to the work of British agents who, during the Revolution, were located at Spring Place; still another tradition is that a band of desperadoes who infested this country in the early days used this walled inclosure as their base of operations. All of these stories are mere rumors and it is probable that none of them is correct. One thing, however, is evident, and that is that the work was planned by some white man familiar with military engineering, for the fortification is well laid out with bastions that serve to protect all parts of the wall. The old ruin is very interesting and it, together with the excellent view of the Valley to be obtained from the summit of the mountain, is well worth the climb to its top.

South of Ramshurst the so-called mountains on the east and south sides of the Valley are really the steep edge of the Central Upland whose surface, though somewhat rolling and dissected by the streams, is a fairly level plateau 700 to 800 feet above the Valley floor. As shown in Fig. 4, the line, separating the Central Upland from the Valley, follows a course nearly due south from Ramshurst into the northern part of Bartow County, and from that point swings in a gentle curve by way of Cartersville and Rockmart to Esom Hill, near the west line of the State.

In places the Valley is not so sharply differentiated from the Central Upland as the statements heretofore made would seem to imply, for the Upland, where it is low and somewhat broken by stream valleys, can with difficulty be separated from hilly sections of the Valley. One such area underlain by slate occurs northeast of Rockmart. The railroad from Cartersville to Rockmart follows the margin of the Valley lowland by Posco and Davites to Rockmart whereas the boundary line is drawn about 4 miles to the southeast. The reason for this difference is that from a geological point of view the slate of this area must be classed with the rocks of the Valley rather than with those of the Upland, and hence it seems rather more logical to regard the slate hills as merely part of the irregularities of the Valley floor than as a part of the Upland to the southeast.

The line separating the Valley province from that of the Appalachian Plateaus on the west is more regular and easily identified than the line separating the Valley from the mountains on the east, because it follows the base of Lookout Mountain the entire distance across the State and this mountain, being straight for a long distance, partakes more of the character of the Valley ridges than it does of the irregular mountain masses on the east side of the Valley. The only irregularity in this boundary line is where it turns back abruptly around

Photograph A. by R. H. Haseltine.

A. SUMMERVILLE, THE COUNTY SEAT OF CHATTOOGA COUNTY.
B. FORT MT. ONE OF THE INTERESTING POINTS ON THE EASTERN BORDER OF THE VALLEY.

the pointed end of Pigeon Mountain which, in reality, is a prong projecting to the northeast from the eastern side of Lookout Mountain, The reentrant angle in this line is shown in Plate XL and in Fig. 4.

The Valley, as thus outlined, includes the whole of Catoosa, Floyd, and Whitfield counties and the larger parts of Bartow, Chattooga, Gordon, Murray, Polk, and Walker counties. Its area is approximately 2,800 square miles, and its population, according to the census of 1920, is about 171,000. As the area of the State according to Gannett[1], is 59,265 square miles, and its population, according to the census of 1920, 2,895,832, it follows that in area the Valley is one-twenty-first, and in population, one-seventeenth of that of the State.

Farming and stock-raising are some of the principal industries in the Valley province, but, notwithstanding the fact that it contains some very rich land, its agricultural products are generally below those of other parts of the State. This probably is due to the fact that, although some areas of the Valley are very productive, other areas are very unproductive, and many of the ridges can not be farmed at all. The relative importance of the agricultural products of this part of the State may be summarized by the following statement of the rank of the counties in their production of various agricultural commodities: Bartow County [2] is in the first rank in the raising of poultry; the second rank in the raising of wheat and corn, and the third rank in the raising of cotton. Floyd County is in the first rank in the raising of poultry and horses; the second rank in the raising of corn and Irish potatoes; and the third rank in the raising of cotton. Gordon County [2] is in the second rank in the raising of wheat, and the third rank in the raising of cotton. Murray County[2] is in the first rank in the raising of horses, and the second rank in the raising of wheat and Irish potatoes. Polk County is in the second rank in the raising of wheat. Walker County[2] is in the first rank in the raising of poultry, horses, milk cows, apples, strawberries and hay; and in the second rank in the raising of wheat and Irish potatoes. Whitfield County is in the second rank in the raising of wheat.

The value of all crops for the year 1919, according to the census of 1920, is as follows: Bartow,[2] $6,793,472; Catoosa, $1,585,960; Chattooga, $3,504,672; Floyd, $6,668,128; Gordon,[2] $4,739,462; Murray,[2] $2,326,989; Polk,[2] $4,435,430; Walker,[2] $3,720,384; and Whitfield, $2,915,278. As the value of the crops of the entire State in the same year was $540,613,626, the farm products of the Valley in 1919 were about one-fifteenth of those of the State.

Mining is also an important industry in the Valley province, but the amount of mining fluctuates greatly from year to year, depending upon the demand for the finished products and the amount of competition between domestic and foreign producers.

[1] Gannett, Henry. The areas of the United States, the States, and Territories: U. S. Geol. Survey Bull. 302, 1906.

[2] These counties lie partly in other provinces, but the areas so situated are generally small and mountainous, and do not figure largely in the farm products listed above.

Cement is produced at Cement, Bartow County, Rossville, Walker County, and at Rockmart, Polk County. Bauxite, the ore from which aluminum is produced, is mined mainly in Floyd County.

Red fossil iron ore is found in Walker, Chattooga, and Catoosa counties; and brown ore in Polk, Bartow, and Floyd counties. Manganese ore is confined chiefly to Bartow, Polk and Floyd counties. Ocher and barytes are produced mainly in Bartow County. In this connection it is interesting to note that Georgia furnishes more than one-half of the yellow ocher produced in the United States and a large percentage of the barytes.

Slate for various purposes is quarried in Bartow and Polk counties and it is also found in Gordon and Murray counties. In connection with the slate industry it should be noted that the slate of this belt contains from 7 to 10 per cent of potash, which at the present time can not be recovered at a profit, but which constitutes a resource of great value, as doubtless chemists will discover a method by which it may be made available for enriching the worn-out agricultural lands of the State.

Tripoli occurs in many of the Valley counties, especially near Spring Place in Murray County, at Dalton in Whitfield County, and at Lyerly in Chattooga County.

A careful study of the surface features of the Valley province shows that, although when considered in a broad way, it may be said to have a flat bottom or floor, it has, in reality, a greatly diversified floor, consisting in part of plains, in part of low rounded ridges, and in part of sharp serrate ridges some 200 to 300 feet high. These features are but the reflection of the kind and attitude of the rocks that underlie the surface, for, as stated previously, the processes of erosion act differently on different kinds of rocks, producing the forms noted above.

To realize fully the effect of the rocks on the surface features, the student should have before him a geologic map of this most interesting region. Such a map, showing the geology of the entire Valley, was issued by the Geological Survey of Georgia[1] in 1912.

If the reader is so situated that he can not readily examine the Valley himself the next best substitute is to study carefully the contour maps[2] of this region that have been issued by the United States Geological Survey. The brown contour lines on these maps show the shape and elevation of every part of the surface, and hence by the use of these maps it is easy to determine whether the surface of any particular part is a plain or a ridge, and if a ridge, its shape and also its height.

A study of the contour maps shows clearly that the Valley may be divided roughly into three parts, each of which has features that dis-

[1] Maynard, T. Poole, A report on the limestones and cement materials of north Georgia: Geol. Survey of Georgia, Bull. 27, 1912.

[2] The maps referred to are maps of the Dalton, Ringgold, Stevenson, Cartersville, Rome, and Tallapoosa quadrangles, on a scale of 2 miles to 1 inch, and maps of the Cohutta, Talking Rock, Cartersville Special, and Stilesboro quadrangles on a scale of 1 inch to 1 mile, that cover parts of the same area as the ones previously mentioned.

tinguish it and make it different from the other parts. The sketch map, Fig. 4, shows these divisions. The first and most important of them may be called the Rome Valley. It embraces most of the territory lying on the east and south sides of the Valley, having an average width of about 20 miles.

The next division lying to the west of the Rome Valley is characterized generally by ridges of different height, ranging from a few hundred feet to as much as 1,000 feet above the valley floors. The ridges generally trend parallel with the bounding walls of the Valley and the belt of such ridges has an average width in this State of about 11 miles. There is no regional name known to the writer which is applicable to these ridges; therefore, he has called them the Armuchee Ridges, from the village of the same name on Armuchee Creek, north of Rome.

The next division to the west partakes more of the valley type and it will here be called the Chickamauga Valley because Chickamauga Creek drains the northern part, including McLamore Cove on the west side of Pigeon Mountain. Chickamauga Valley, as defined above, has a width on the Tennessee line of about 14 miles and on the west line of Georgia of about 10 miles.

ROME VALLEY

The Rome Valley is the largest division of the Valley province of Georgia. It ranges in width from 13 miles on the Tennessee line to 25 miles at Cartersville, and 21 miles on the Alabama line. It is drained almost entirely by Coosa River and its tributaries, among which the Oostanaula is the most important, being the one that has the greatest extent in this section. As the city of Rome is located at the junction of the Oostanaula and Etowah rivers—the main branches of the Coosa—that name is here given to the entire valley extending from the Tennessee line on the north to the Alabama line on the west. This valley is separated from the Armuchee Ridges by a line which follows the eastern base of more or less continuous ridges that extend from the Tennessee line on the north to the Alabama line on the west. Near the Tennessee line the ridges are not very conspicuous, but, in a general way, the boundary coincides with the Southern Railway from the village of Red Clay near the State line southward for a distance of 10 miles. At this point the railroad veers off to the east to the town of Dalton, but the boundary line follows the east base of Chattoogata Mountain about 2 miles west of Dalton. This mountain dies out about 12 miles south of Dalton and here the boundary swings to the west and follows for a distance of 10 miles the east base of Horn Mountain. From the south end of Horn Mountain to the east end of Lavender Mountain, a distance of about 10 miles, there is no ridge to mark the boundary line, so it has been drawn to unite these two ridges and to exclude from the Rome Valley the short ridge of Turkey Mountain. From the east end of Lavender Mountain to the west line of Georgia and for a distance of 4 or 5 miles beyond this line there is a group of short and irregularly trending ridges which

borders the plain of Coosa River on the north. The boundary line is so drawn as to exclude these ridges from the Rome Valley, and for the most of the distance it corresponds in position with the line of the Southern Railway through the villages of Coosa, Mount Hope and Early.

The Rome Valley is truly a valley because it constitutes the lowest land in the Valley province and it contains all of the large streams of the region. Thus Conasauga River, which enters the valley from Tennessee is a fairly large stream, receiving most of its waters from the mountains of Murray and Fannin counties. This stream flows northward from its source in the Cohutta Mountains as though it were a branch of the Ocoee River of Tennessee, but a short distance beyond the State line it turns to the west for about 4 miles and there abruptly changing its course to the south crosses the State line into Georgia. It continues southward until, within a few miles of Calhoun, it unites with Coosawattee River, which also has its source in the mountains to the east.

The river formed by the junction of the Conasauga and the Coosawattee is called the Oostanaula. This stream flows in a course that may be considered as the prolongation of that of the Conasauga, to Rome, where it unites with Etowah River, which drains a large area of the Central Upland on the east. Coosa River, formed by the junction of Oostanaula and Etowah rivers in the city of Rome, flows nearly due west to the Alabama line, which it crosses about 4 miles south of the Southern Railway. Beyond the confines of the State of Georgia Coosa River units with Tallapoosa River to form Alabama River, which reaches the Gulf at the port of Mobile.

The lowest point in the Rome Valley is where Coosa River crosses the Alabama-Georgia State line, at an elevation of about 600 feet above sea level. From this point the surface rises steadily to a little more than 700 feet on the Tennessee line. The highest point in the valley is the summit of Indian Mountain, with an elevation of 1,967 feet above sea level. This mountain, however, lies mainly in Alabama, only the eastern end extending into Georgia.

Although the surface of this valley has been referred to as mostly a plain, it must be recognized that there are a few isolated and rather insignificant ridges, hills, and even mountains within its borders. The most prominent of these elevations is Indian Mountain, just described; other eminences are Horseleg Mountain, a short ridge southwest of Rome, rising to an elevation of 1,526 feet, and Armstrong Mountain, 8 miles northeast of Rome, which attains an elevation of about 1,200 feet above sea level. There are a few other isolated hills and ridges in the vicinity of Rome, but none is of sufficient magnitude to deserve a name.

The smoother portion of the valley floor is composed mostly of limestone which dissolves quite readily, and this ease of reduction is largely responsible for such level land as is shown in Plate XXIX-A and XXXIX-B. The decay of the limestone produces in most cases a rich soil; hence generally speaking, lands that are underlain by lime-

stone are more productive than those underlain by other rocks, but in a few places there are exceptions to this general rule, for some of the limestones do not produce a rich soil, and some contain so many nodules of chert (flint), that the soil is covered with a thick coating of chert fragments which effectually prevents tillage and renders the land the poorest in the province. On the other hand, some of the shale bands which occur in the Rome Valley are very productive, because the shale is calcareous (limy) and makes not only a good soil, but also a soil free from rock fragments that might interfere with its cultivation. The Coosa Valley below Rome is a good example of rich farming lands developed on such shales.

The largest town in the valley is Rome, the county seat of Floyd County, with a population in 1920 of 13,252. It is situated at the junction of Oostanaula and Etowah rivers, in the midst of one of the richest agricultural districts of the State, and with excellent railroad and highway connection with almost all towns in the northwestern part of Georgia and in adjacent parts of Alabama and Tennessee. Dalton, the county seat of Whitfield County, is second in size, with a population of 5,222. This town also is situated in a well cultivated portion of the Valley and has good railroad communication with towns to the north and the south, but in the other directions, it is hemmed in by valley ridges on the west and by the Cohutta Mountains on the east. Cartersville is third in rank, with a population of 4,350. It is well situated 2 miles north of Etowah River and is the distributing point for an unsurpassed agricultural district in the Valley as well as a large district in the Central Upland to the east. It has direct railroad communication with Atlanta and Chattanooga and is on the line of the Dixie Highway between these two cities. Cedartown, the county seat of Polk County, is fourth in the list, having a population of 4,053. It is surrounded by some of the best agricultural land in the State and has ample railroad and highway connections with nearby towns and the more distant centers of population in this and adjacent States.

The Rome Valley, because of its generally flat surface and because it unites with similar valley lands to the north and the west, is favorable territory for the building of railroads and consequently, all of its larger towns are connected by one or more lines, and these towns are also connected with the larger centers of population outside of the State in both directions. The railroad lines operating in this section are given in the following list: Southern Railway: a line from Cleveland or Ooltewah, Tennessee, down the valley, through the towns of of Dalton, Sugar Valley, Plainville, Rome and Rockmart to Atlanta; a branch from the line described above extends through Cave Spring, to Anniston, Alabama, and another branch from Rome westward down the valley to Gadsden, Alabama. Louisville and Nashville Railroad: a line from Knoxville, Tennessee, down the valley through Chatsworth and Fairmount to Cartersville. Nashville, Chattanooga and St. Louis Railway, operating a road built by the State of Georgia from Atlanta to Chattanooga, Tennessee, through the towns of Cartersville, Kingston, Adairsville, Calhoun, and Dalton; and a branch

from the line just described from Kingston to Rome. Central of Georgia Railway: a line from Chattanooga, Tennessee, through the towns of Rome and Cedartown and on to the south. Seaboard Air-Line Railway: a line from Atlanta to Birmingham, Alabama, through the towns of Rockmart, Cedartown, and Esom Hill.

The Rome Valley is not well enough supplied with good roads to tempt auto drivers to depart very much from the beaten paths connecting one city with another, and even these roads are not all hard-surfaced or even good gravel roads. The principal road through this section is the Dixie Highway from Atlanta to Chattanooga, Tennessee (139.5 miles). This road enters the valley at Cartersville and proceeds down the north side of Etowah River to Rome, but recently a new road has been opened between these places, which crosses Etowah River near Euharlee and then follows a direct route to Rome. From Rome the road passes through the village of Armuchee at the margin of the ridge section of the same name and thence on to Summerville and Chattanooga. There is no striking scenery along this highway in the Coosa Valley, but its course takes the traveler through some of the finest farming land of the south. A drive through this section in August when the corn fields are in their prime and the cotton fields, a mass of red and white flowers, is a sight never to be forgotten, specially to those who are not accustomed to the sight of a field of cotton in full bloom.

If the traveler so desires, he may depart from the main line of the Dixie Highway, as described above, by turning north a short distance west of Cartersville and passing through Adairsville and Dalton. This road joins the main road near the Chickamauga Battlefield, a few miles south of Chattanooga. It is much shorter than the main highway through Summerville, but it is not so good and most persons prefer to keep to the well-traveled highway.

Another of the principal auto roads of this part of the State, running from Atlanta to Gadsden, Alabama, enters the valley near Felton, on Dugdown Mountain; it passes through Cedartown and Cave Spring and crosses the west line of the State at the village of Haynie on the southwest corner of Floyd County.

Although the Rome Valley has little in the way of scenery to interest the ordinary traveler, it is the gateway to the Cohutta Mountains on the east, and these mountains offer many beautiful views to the traveler who loves nature in her varying moods. The Appalachian Mountains may not have the rugged grandeur of the mountains of the West but they have a beauty of their own which can not be found outside of a humid climate. This beauty consists of endless vistas of rolling mountain slopes covered thickly with a mantle of trees that are green in mid-summer but change to all the hues of red and brown with the approach of autumn and the first frosts of winter. There are many rocky ravines in these mountains, filled with a rank growth of rhododendron through which no man can force his way, but which in mid-summer is one mass of gorgeous bloom, overhanging perchance a rushing mountain torrent which plunges down the

steep mountain slope with many falls and deep pools filled with giant boulders. Many are the beauties that may be found in this region if one is content to forego the conventions of modern civilization and for a time to live close to nature's heart.

ARMUCHEE RIDGES

The section of the Valley here designated the Armuchee Ridges lies west and north of the Rome Valley. The boundary line separating the two sections has been described as following the east and south sides of the main ridges lying west of Dalton and Calhoun and northwest of Rome. This boundary crosses the Georgia-Alabama State line at the village of Early. A few miles west of the State line the ridges terminate in a point near the village of Lawrence, Alabama, and consequently, the section called the Armuchee Ridges ends here.

The northwestern boundary of the Armuchee Ridges begins at the point mentioned in the preceding paragraph, near Lawrence, on the northwest side of Scraper Mountain; it extends northeastward along the foot of Gaylor Ridge to Holland, where there is a break in the ridges of about 4 miles. To all intents and purposes, however, Gaylor Ridge is continued in Taylor Ridge and the boundary follows this ridge to the town of Ringgold, which is located in the water gap that marks the point where Chickamauga Creek has cut its way through the ridge. Beyond Ringgold the ridge continues to the Tennessee line but here it is generally known as White Oak Mountain.

The surface of the section called Armuchee Ridges is characterized by a number of long, straight, linear ridges, or ridges that curve about like a fishhook or have backward pointing barbs at their ends. Throughout most of the section the ridges rise to a height of about 700 feet above the floors of the intervening valleys.

The striking contrast that exists between the great plain which makes up most of the Rome Valley and the rough surface of the Armuchee Ridges is due entirely to the differences in the rocks composing those surfaces and also differences in the attitude of these rocks, or, in other words, the geologic structure. In the Rome Valley to the east, the rocks at the surface are mainly limestone and easily decomposed shale, and these rocks weather down readily to a nearly uniform surface; but in the Armuchee Ridges the rocks showing at the surface consist of alternating beds of limestone, sandstone, and shale, of various degrees of hardness. The limestone, here as elsewhere, gives rise to valleys, whereas the sandstones, especially where they are tilted at various angles, produce ridges, the height of the ridge depending largely upon the hardness and thickness of the sandstone. Shale is intermediate in hardness and resistance to erosion between limestone and sandstone, and it tends to produce low ridges or foothills flanking the higher features.

Most readers will doubtless want to know why the rocks do not lie horizontally, as they do in many parts of the country, and why they are tilted at various angles. Most of the rocks now to be seen in the Appalachian region were long, long ago laid down in the sea

which then covered all of this region. After a thickness of many thousands of feet was deposited on the sea bottom, the crust of the earth was elevated and the rocks became dry land. At the same time there was throughout the whole of the Appalachian region immense pressure exerted on the rocks from the southeast, and under this pressure the rocks bent into folds in the same way that a block of paper will bend into folds when crowded together from both edges. The cut edges of some of these folds are shown in Fig. 5. As the rocks involved in this movement had a thickness of 8,000 to 10,000 feet the folds must have been of enormous magnitude.

As soon, however, as the rocks appeared above the surface of the water, they were attacked by erosion—that is, by the process of weathering and by rain and running water, and they were gradually reduced in height—possibly as fast as they rose above the level of the sea. As the process of erosion tended constantly to wear the land down toward sea level, the surface would eventually reach that level unless the crust of the earth were raised again. As this raising of the earth's crust has happened many times in the past, it is easy to understand that at some time long ago the mountainous region of Georgia may have been a plain but little above sea level, and that its present height is due entirely to subsequent uplifts. In the present cycle of erosion the surface of the valley has been reduced considerably below that of the adjacent uplands, but it was not subjected to these processes long enough to cut away the hard rocks, and consequently they stand above the general level as ridges, their height depending upon their ability to resist the lowering effect of erosion.

With this brief resume of some of the movements and processes that have occurred in the Valley region, we can now better understand what the ridges mean and why they have been left in their present shape and elevation. Those ridges which are long and regular in shape and height are generally caused by the edge of a layer of hard rocks tilted at a considerable but constant angle for a long distance; ridges with hooks or barbs on their ends have assumed that shape because they are the result of the erosion of folds, either arches or troughs, that are coming to an end. The relation of surface ridges to great rock folds is shown in Fig. 5, which is supposed to represent the beds of rocks as they would appear in the side of a deep trench cut across the Armuchee Ridges northwest of Rome. The section is so drawn that it cuts the three main ridges—Taylor Ridge, Simms Mountain, and Lavender Mountain —and also a short round mountain known as Rocky Mountain. Taylor Ridge is shown at A, Simms Mountain at B, and Lavender Mountain at D. The short Rocky Mountain is shown at C.

The hardest bed of rock involved in these folds is known generally throughout the Southern States as the Red Mountain formation. It is mainly a sandstone and is well known because it carries most of the red iron ores in this State and the Birmingham region. This bed is represented in the section by dots. As will be noticed, it makes its appearance on the left as an easterly dipping bed in Taylor Ridge.

Because it dips to the east the ridge has a gentle slope on that side and a steep slope on the west side, which is formed by the cut edges of the beds of rock. From Taylor Ridge it dips into a narrow trough or syncline and then immediately reappears, standing in nearly a vertical position in the cross ridge connecting Taylor Ridge and Simms Mountain. The upward rise carries the bed only a short distance above the surface and then it turns abruptly and descends almost as steeply in Simms Mountain, forming a closely compressed arch or anticline. From Simms Mountain it passes under Rocky Mountain in a shallow syncline and reappears in nearly a vertical position in Lavender Mountain, but in this mountain the fold is overturned, the beds rising from the northwest side and passing down into the southeast side of the mountain on a dip of about 70°. Rocky Mountain is composed of a higher bed of sandstone, lying nearly flat in the middle of a syncline and that is why it is not a long ridge like either Simms Mountain on the north or Lavender Mountain on the south.

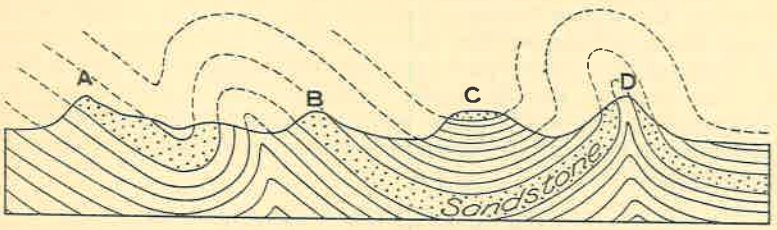


Figure 5. Structure section showing the relation of hard rocks to the surface features in the Armuchee Ridges.

Before the surface was worn down to its present level the folds in the sandstone were complete, as indicated by the dotted lines, but now only the synclines or troughs remain and at some time in the future the surface may be lowered to such an extent that even the basins or troughs, as they are represented by the Red Mountain formation, may be eliminated.

The rocks in this section are diverse in their composition, and it follows as a matter of course that the soils resulting from the decay and disintegration of these rocks will differ greatly in productiveness. As the valleys are generally floored by either limestone or shale the soil of the valleys is fairly good or excellent, whereas the soil of the ridges is very poor, especially if it is the result of the weathering of sandstone. As a rule the valley lands, because of their flatness and productivity, are cleared and cultivated, whereas the ridges, because of their roughness and infertility, have generally been left in their original wooded condition, but even on the ridges the better trees were cut long ago for lumber.

The ridges in this section have been quite a barrier to transportation in an east-west direction. It is true that they are not very high, but roads built across them are generally steep and rocky and are avoided when heavy freight is to be transported or when trips are

made for pleasure only. There are two improved highways across this section: one at the south end, and the other at the north end. The former is the Dixie Highway leading from Atlanta to Chattanooga, Tenn. This road is supposed to be the best in the Valley province. It crosses from Rome to Summerville by way of Armuchee. In pursuing this course it follows the open valley from Rome to the village of Gore on the east side of Taylor Ridge. Immediately west of this village is a low "wind gap" in the ridge, which has been utilized to save climbing over the summit. The road at the north end of the section crosses from Dalton to Ringgold, but here only two ridges have to be crossed and there is a stream gap in each, affording a natural highway between the east and the west.

In a similar manner railroads have avoided the section because of the great cost of construction and the steep grades and short curves that would have resulted if railroad building had been attempted here. The only railroad line crossing the southern part of this section is the Central of Georgia Railroad which extends northwestward through Rome to Summerville, Lafayette, and Chattanooga. The railroad crossing the northern part is a State road but operated by the Nashville, Chattanooga, and St. Louis Railroad, from Dalton on the east to Ringgold on the west. Each railroad turns and twists among the ridges until a low gap is found which does not involve exceedingly heavy grades.

CHICKAMAUGA VALLEY

The section here called the Chickamauga Valley lying between the Ringgold Ridges on the east and Lookout Mountain on the west, embraces a belt of country about 8 miles wide at the south and 13 miles at the north. In general the surface of this valley is lower than either the ridges on the east or the plateau on the west, and its floor is fairly level and smooth. There are, however, a number of low ridges, more or less continuous, running lengthwise of the section and at the southern extremity Dirtseller Mountain rises like a wooded island to a height of 700 feet above the sea of cultivated land that surrounds it.

The great width of this section in its northern part is due to the fact, as heretofore stated, that toward the north Lookout Mountain forks, and McLamore Cove which lies behind the eastern prong of the mountain unites with the main valley a little north of Lafayette giving it the increased width noted above.

The Chickamauga Valley section lies on the divide between the drainage basin of Tennessee River on the north and Coosa River (Alabama River) on the south. The divide crosses the valley about 5 miles north of Lafayette. The water falling south of this divide is carried by Chattooga and Coosa rivers to Alabama River and that falling north of the divide is carried by Chickamauga Creek into Tennessee River 4 miles above Chattanooga. The divide between these two main drainage basins of the continent is not, however, a barrier to intercommunication between them, for in passing over it one is

scarcely aware that he has passed from northward to southward flowing streams, or *vice versa,* as the case may be.

The rocks underlying the Chickamauga valley are almost exclusively limestone, but include a few bands of shale. These produce on weathering, a good soil, which renders it one of the most productive parts of the Valley province. The principal towns are prosperous and attractive, as shown by plate XXXIX-A, which is a view of Summerville, the county seat of Chattooga County.

This section is traversed in a north-south direction by two railroads: the Tennessee, Alabama, and Georgia Railroad on the west side of the Valley at the foot of Lookout Mountain, and the Central of Georgia Railroad which occupies the middle or eastern part of the valley. The State road, operated by the Nashville, Chattanooga and St. Louis Railroad Company, crosses the northern part, but only a few miles of this line are in the Chickamauga valley section of Georgia. The Chickamauga Valley section also contains that part of the Dixie Highway which lies between the Tennessee line and the town of Summerville.

LOOKOUT PLATEAU

By Marius R. Campbell

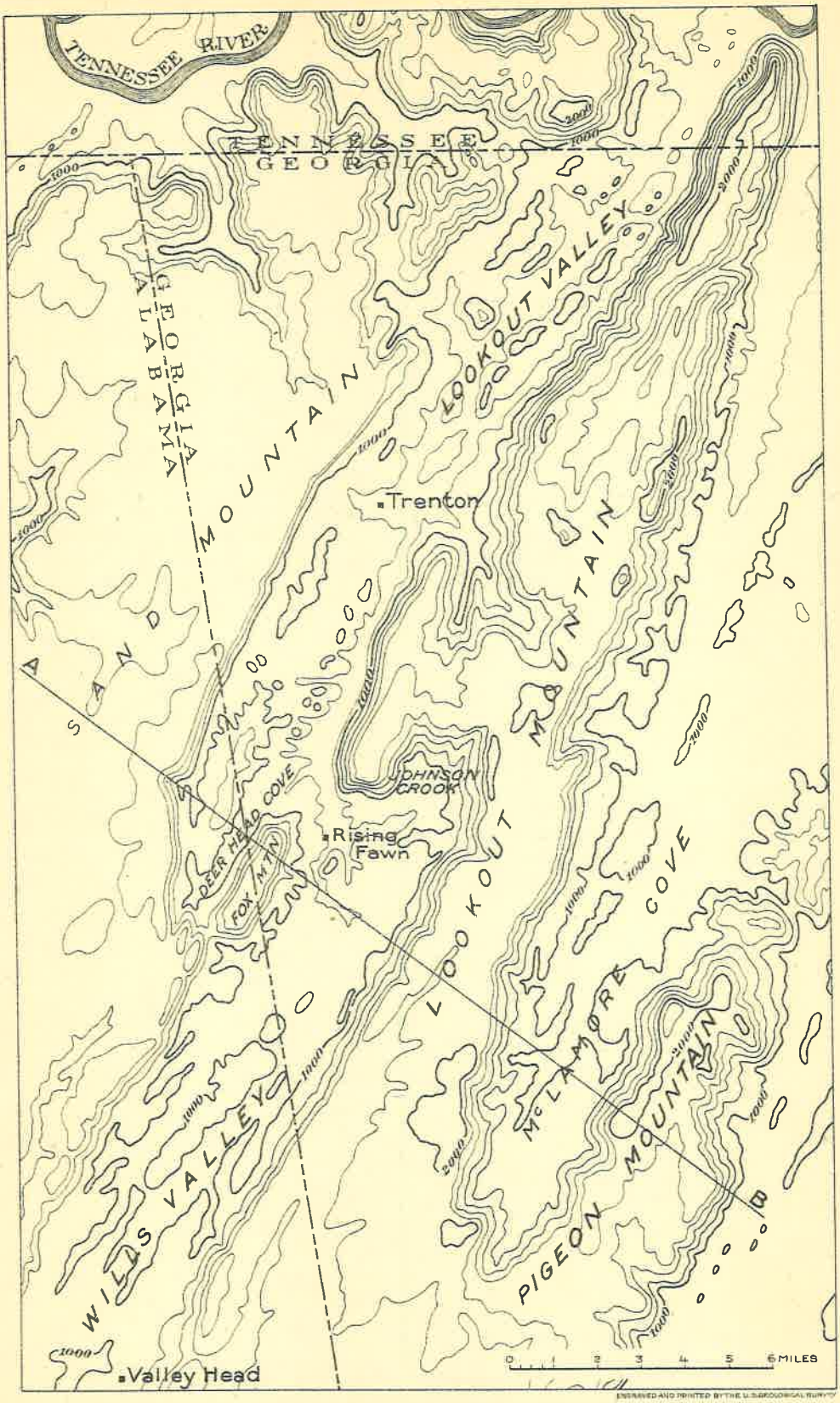
GENERAL DESCRIPTION

Throughout the entire region, the Appalachian Valley is bounded on the northwest by the Appalachian Plateaus, a region consisting of table lands (plateaus) of different heights and of different degrees of perfection. Some, like the coal field of West Virginia, are so greatly dissected that no level land remains and the hill-tops alone are left to mark the original even surface; others, on account of the hardness of the rocks underlying them, still retain their original form. Those in Tennessee are known as the Cumberland and Walden Ridge plateaus and those in Georgia as Lookout Mountain and Sand Mountain plateaus. In this report the name Lookout Plateau will be used in a general sense and it should be understood that it includes Sand Mountain as well as Lookout Mountain.

The Valley, as it has been described on a previous page, is bounded on the west, as shown in Plate XL and Fig. 4, by a flat-topped ridge, known as Lookout Mountain, which extends from just south of Chattanooga, Tennessee, to the vicinity of Gadsden, Alabama, an air-line distance of about 80 miles. This feature is usually called a mountain because it stands distinctly above the valley on the east and, as seen from that direction, appears much like the other ridges or mountains that rise above the level valley floor. It is, however, flat-topped throughout most of its extent, and, therefore, is more appropriately styled a plateau than a mountain.

The reason for the application of the name "Lookout" to this plateau is somewhat uncertain; many suppose that it is because of the wonderful and greatly extended view that may be had from its extreme northeastern end, shown in Plate XLI where it overlooks the Tennessee River for a long distance and the city of Chattanooga nestling at its foot; others say that the name was given to this prominent point by boatmen on the river because at the point where the mountain appeared most prominently in the landscape was the place to "look out" for Indians. The part of the plateau lying in Tennessee, although only a mile or two in extent, is the best known part, because of its association with the city of Chattanooga, but the bulk of the plateau lies in Georgia and Alabama.

Lookout Mountain, or rather Plateau, is bounded on the northwest as shown in Plate XL, by a narrow valley which is of the same longitudinal extent as Lookout Mountain. The northern part of this valley is drained by Lookout Creek, a tributary of Tennessee River, and the southern part, by Wills Creek, a tributary of Coosa River. Beyond (northwest of) this valley lies the great plateau of Sand Mountain which received its name from the generally sandy character of the soil that is found on its top. Sand Mountain ex-



THE PRINCIPAL TOPOGRAPHIC FEATURES OF THE LOOKOUT PLATEAU

Contour interval 200 feet

tends far to the south, but in the other direction the name is restricted to the plateau lying south of Tennessee River, although the river gorge, scarcely more than a mile wide, is all that separates it from a similar plateau north of the river, that is known as Walden Ridge. For a long distance from its northern end Sand Mountain is bordered on the northwest by the valley in which Tennessee River flows in its southwestward course from Tennessee into Alabama.

Lookout Mountain, Sand Mountain, Walden Ridge, and the Cumberland Plateau which lies west of Sequatchie Valley are, as shown in Plate XL, at about the same elevation and it requires only a slight stretch of the imagination to conceive of them as being at one time united in a vast plain that stretched from central Alabama northeastward nearly to the Kentucky line.

Geologists are generally agreed that such was the condition of the plateau in this region many, many ages ago. The general flatness of the surface can be explained only on the supposition that at that time the crust of the earth remained stationary for an exceedingly long time and this quiescence on the part of the crust permitted the streams to wear the surface down almost to sea level. At that time it is supposed that all of the region west of the Cohutta Mountains was one vast plain and this plain extended northward to Kentucky and eastward across Georgia, south of the mountains, to the Atlantic Ocean. The time was so long that hard and soft rocks alike were reduced to a common level and the plateaus we see to-day are but remnants of that even surface which now has been cut by the streams until its level character is largely gone.

Following the formation of this vast plain, or peneplain (meaning nearly a plain), came many uplifts of the region until now the surface which was formed near sea level is in places as much as 2,000 feet above that datum plane. The reason why Sand Mountain and the other plateau surfaces have been preserved through this great lapse of time is that they are underlain by a thick bed (Lookout) of very resistant sandstone which has prevented most of the streams from cutting valleys in them. The relation of this bed of sandstone to the surfaces of the various plateaus is shown in Fig. 6. which represents the rocks as they would appear in the side of a deep trench if such a trench were cut across Sand Mountain, Lookout Valley, Lookout Mountain, McLamore Cove, and Pigeon Mountain, along the line A B shown in Plate XL.

When the rocks of this region were folded as described on pp. 146-147 four low anticlines were formed in what is now regarded as the Lookout Plateau. One of these anticlines is marked today by Sequatchie Valley, another by Lookout Valley, another by Wills Valley, and another by McLamore Cove. The thick bed of sandstone lies just under the surface in the intervening shallow synclinal troughs but on the anticlines it was arched up several hundred feet. When the surface was planed off as described previously, the sandstone arches were cut away leaving softer rocks at the surface; then when the region was uplifted the streams were able to cut deep valleys on the

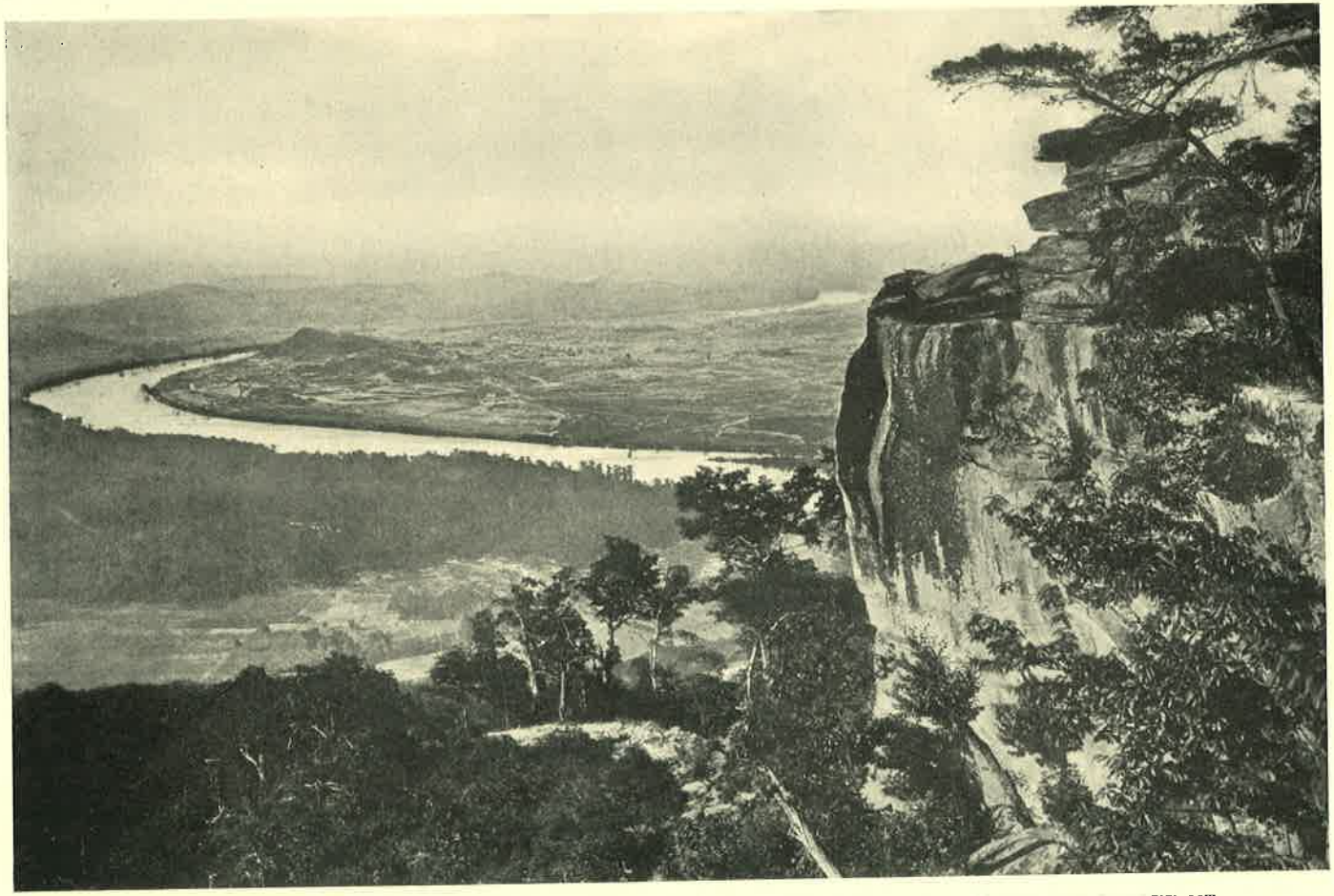
anticlines where the sandstone was cut away and the excavation of the valleys as we know them today was begun. Since then they have been deepened after every uplift of the region until they are from 800 to 1,200 feet deep.

Because of the present separation of Lookout and Sand mountains some geographers have contended that Lookout Mountain should be regarded merely as an outlier of the great Cumberland Plateau and that the valley on its northwestern side should be considered a part of the Valley to the east. If such a scheme of classification were followed out logically every mountainous ridge in the Valley should be considered as an outlier either of the mountains on the east or the plateau on the west. A moment's consideration of such a proposition will serve to show its impractical nature, and that Lookout Mountain and its accompanying valley on the west should be considered together as a part of the Cumberland Plateau or a part of the Valley on the east. As the mountain is a much more prominent feature than the valley, the writer chooses to consider it a part of the Cumberland Plateau and the valley behind it as merely one of the several valleys that trench its generally even surface.

The character of the surface of the Lookout Plateau is shown in Fig. 6. From this figure it will be seen that the surface is not flat but slopes gradually to the southwest and west. The highest part is on Lookout Mountain near the north line of Georgia; here the surface has an elevation of about 2,000 feet above sea level. From this high point the surface descends southwestward along the mountain to about 1,500 feet in the vicinity of Gadsden, Alabama. On Sand Mountain, in the northwestern corner of Georgia, the greatest elevation is about 1,700 feet above sea level. From this elevation the surface descends to about 1,300 feet at a point northwest of Gadsden.

Lookout Mountain affords some picturesque scenery, as its stee slopes are capped by almost vertical cliffs from 200 to 300 feet in height These present in many places an unscalable wall, but the wall is breached here and there by small streams which have their source on the top of the plateau and reach the valley floor through deep notches in the bounding cliffs.

Near the Alabama-Georgia State line a great spur branches off to the east from Lookout Mountain. This spur, which is known as Pigeon Mountain, partakes of the same general character as the main ridge, being flat-topped for a distance of 9 miles, but beyond this point it is broken by many gaps and degenerates into an irregular ridge which terminates at a point about 18 miles from the main mountain. Pigeon Mountain is bounded on both sides and at the end by sandstone cliffs which give to it a very rugged appearance. Its greatest elevation is near the extreme northeastern point, where a low knob on the northwestern side attains an elevation of 2,329 feet. The northwestern side of Pigeon Mountain is very regular in outline, only small gulches being cut in its steep slopes, but the southeastern side is broken by a number of gulches, or "gulfs" as they are generally called in this region. This mountain is separated from



TENNESSEE RIVER AND THE CITY OF CHATTANOOGA FROM A CLIFF AT THE NORTH END OF LOOKOUT MT.

the main Lookout Mountain by McLamore Cove, a branch of the valley which is drained by West Chickamauga Creek, a tributary of Tennessee River.

Gulf Mountain, at the head of McLamore Cove, rises about 1,200 feet above the valley of West Chickamauga Creek, This is one of the highest points near the State line. From Gulf Mountain the eastern margin of Lookout Plateau extends in an almost straight line to Lookout Point near Chattanooga. Throughout this distance of about 30 miles the cliffs that bound the plateau on the east are almost unbroken, being notched deeply at only one place—the place where Rock Creek has succeeded in cutting its way through the massive sandstone in a deep and rugged gorge. This rugged line of cliffs has proved to be a very formidable barrier to travel in an east-west direction and only 3 or 4 mountain roads have been able to find a way to the top of the plateau.

North of Gulf Mountain there are three prominent points or low peaks that stand upon the eastern rim of the plateau and rise above the rim to heights of from 200 to 400 feet. In passing northward the first high point is Round Top which has an elevation of 2,378 feet. This mountain is only about a mile north of the wagon road from Cooper Heights to Trenton, and because of its isolation and symmetrical shape, it is a commanding object as seen from the valley on the east. High Point, 2 miles farther north, is the highest summit on Lookout Mountain, having an elevation of 2,392 feet above sea level. This peak is more elongate than Round Top and its eastern side is a sheer precipice several hundred feet in height. The summit is covered by great blocks of sandstone—the remnants of a bed of rock that once covered much of the mountain but which has been almost all removed by weathering.

North of High Point there is another prominent object known as Eagle Cliff which consists of a great wall of sandstone that seems to project above the general face of the mountain. This wall extends along the mountain front for a distance of 2 miles to McCallie Gap where it is terminated by the gorge of Rock Creek. On the south side of this gorge the sandstone stands out as great pinnacles of broken rock, but on the north side it shows as a great cliff with an almost unbroken face.

Rock Creek, which has cut the gorge at McCallie Gap, rises on the top of the plateau near Round Top and descends to the Valley on the east through a rugged gorge which is broken by deep holes in which there are pools, and by cliffs over which the stream pours in beautiful cascades, as shown in Plate XLII. It is a wild and rugged ravine but it is generally accessible because a railroad has been built up it to the coal mine situated near its head.

On the west side of Lookout Mountain the plateau wall is unbroken from the north end nearly to Trenton. On this side the slopes are steeper and the streams do not seem to have been able to breach the mighty wall at the top. Nearly opposite Trenton, however, the wall has been cut by Bear Creek, one of the eastern branches of Look-

out Creek, and a deep ravine, known as Trenton Gulf, has been excavated in Lookout Mountain. The stream in this gulf has eaten its way headwards until it has reduced the plateau to a single narrow ridge whose crest is the eastern rim of the plateau. The walls of the ravine are steep and in places, capped by sandstone cliffs 200 to 300 feet high. A view of Trenton Gulf from one of these cliffs is awe-inspiring and is very similar to a view of Tallulah Gorge in Rabun County.

South of Trenton Gulf is another gulf of a much larger size. This is known as Johnson Crook and it notches the edge of Lookout Plateau just east of Rising Fawn. Johnson Crook is really the northeastward extension of Wills valley which bounds Lookout Mountain on the west from this point southwestward into Alabama. It is a great amphitheater which is bounded on all sides except the south by sandstone cliffs that give it a rugged and imposing appearance.

South of Johnson Crook the western face of Lookout Mountain is broken by only a few small gulches which extend back into the plateau very short distances.

The water falling on the northern part of the Lookout Plateau in Georgia is generally carried off by small streams which follow the trend of the Mountain for a short distance and then plunge wildly down through deep gulches to the plain below, but that falling in the southern part is carried away by the head branches of Little River which, after uniting with the Chattooga, empties into Coosa River near the town of Cedar Bluff, Alabama. In general Little River throughout nearly its entire course is hemmed in by low ridges on both rims of Lookout Mountain, but opposite Cedar Bluff it cuts through the southeastern rim and seeks the level of the plain below.

Only a small portion of Sand Mountain is included within the boundaries of Georgia, but the surface features of this mountain are essentially the same as the surface features of Lookout Mountain. They differ in degree, and not in kind.

Sand Mountain is much broader than Lookout Mountain and in the northern part where it is not much dissected by streams it has much larger areas of flat land. The surface, near the sides of the plateau, is higher than it is in the middle, but the marginal ridges are so broad that they do not make conspicuous features in the landscape. Southwestward from the wagon road leading from Trenton to Nickajack Cove, near the northwest corner of the State, the southeast margin of Sand Mountain plateau is almost unbroken except for the offset at Rising Fawn around the head of Deer Head Cove. The same thick bed of sandstone that is so prominent on Lookout Mountain is also present on Sand Mountain and is responsible for the plateau-like character of its surface and for the cliffs that border this plateau in almost all places. The cliffs are particularly prominent in the steep slope bordering the east edge of the plateau from Trenton southward to the head of Deer Head Cove. North of Trenton the steep slope continues for a distance of about 3 miles, but beyond that point the plateau is badly broken by Sligo Cove and other valleys, so that

but little of the plateau surface remains. The reason for this greater dissection is that the streams here are all tributaries of Tennessee River and as they have only a few miles to flow until they unite with the river, their courses are steep and because they are steep the streams are able to cut away even the hardest sandstone. The result is that the streams flowing directly to Tennessee River have cut great gorges or coves in the plateau, completely destroying its even surface, but adding very much to the beauty of the scenery, for these gorges are in many places extremely rugged. This is particularly true of the ravine cut by Nickajack Creek in the extreme northwest corner of the State. The crest of the slope is generally bordered by high sandstone cliffs and near Cole the creek is flowing in a rocky canyon several hundred feet deep.

As the surface of the plateau slopes generally to the west, most of the streams have their source near the eastern margin and flow westward directly into Tennessee River, whose course is close to the northwestern margin of the plateau. These streams have cut deep notches or coves into the once even front of the northwest side, but as most of these coves are in Alabama, they will not be described.

Some readers may be curious to know why Sand and Lookout mountains stand higher than the Valley and why their surfaces are in general so nearly flat. This is a very appropriate question to ask, for the geologist has learned that all of the features that characterize the surface of the earth have a meaning, and if one can rightfully interpret them he is able to determine just what conditions have prevailed in the past and how those conditions and the processes that were then going on have helped to shape the present form of the land. In other words, the surface of the land is an open page upon which is recorded the events that have transpired. This record is written in raised forms, much like the Braille style of printing now used for the blind, which we may learn to read and thus become familiar with the real history of the country in which we live.

In imagination, it is possible to go back to a time when the Appalachian region was nearly all reduced to a peneplain, as explained on pp. 146-147, with only mountain groups here and there composed of rocks so hard that they were able to resist the action of the weather and the streams and so remained unreduced. In northwestern Georgia the top of Lookout Plateau marks approximately the position of such an old peneplain. When this feature was produced the plain was complete and unbroken from the Mississippi River in the vicinity of Memphis eastward to the Cohutta Mountains of northern Georgia and to the Smoky Mountains of East Tennessee and its surface was probably only a few score or more feet above sea level. At that time the whole of northwestern Georgia, except the high mountains, was a plain probably more perfect than the plain in the eastern part of the Valley to-day and there was no distinction between what is now the Valley and Lookout Plateau.

The crust of the earth was then upraised and at once the streams began to cut away (reduce) the uplifted land mass, but of course the

softer rocks were the first to be removed and the hard rocks remained for a long time as mountains or ridges standing above the surface formed on the softer rocks in adjacent regions. In Georgia Sand and Lookout mountains were protected by a very resistant bed of hard sandstone, shown in Fig. 6, and so they did not suffer immediate reduction, but the limestone and shale of the Valley were quickly reduced to the plain that we see to-day. The results of this second stage of reduction can best be understood by a study of the accompanying diagram, Fig 6. In this figure, which is supposed to represent

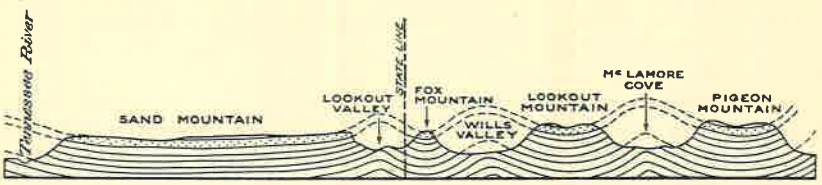


Figure 6. Structure section showing the relation of hard rocks to Sand and Lookout mountains.

the surface and the underlying rocks as they would appear in a deep trench cut across the country, the tops of the plateaus are remnants of the surface just referred to when the land was almost completely reduced to a plain, except possibly some of the mountains to the east of the Valley. As this plain was uplifted the streams cut out Lookout Valley, Wills Valley, and McLamore Cove, leaving Sand and Lookout mountains standing at the level of the old plain. The reason for the particular form of these mountains is to be found in not only the kind of rocks of which they are composed, but in the attitude which those rocks have assumed. In the present case, the rocks have been thrown into folds by strong pressure from the southeast. The bed of sandstone is wrinkled into a broad downward fold or syncline in Sand Mountain; a shorter one in Fox Mountain, another in Lookout Mountain, and still another in Pigeon Mountain; similar but shorter anticlines were produced in Lookout Valley, in Wills Valley or Johnson Crook, in McLamore Cove, and lastly, many large folds east of Pigeon Mountain. When the plain was produced the sandstone in the various anticlines was cut away, exposing the soft rocks that underlie it to the erosion of the streams, but in Sand Mountain and Lookout Mountain the sandstone was downfolded into shallow synclines and, as the bottom of these synclines lay below the level of the peneplain, the sandstone was not removed and since has remained as a protective cap preventing the erosion of that part below the old peneplain level. The anticline, on the other hand, has been deeply cut by streams flowing to the northeast or the southwest along the line of weak rocks that had been exposed by the removal of the protecting cap of sandstone. In this manner Lookout Creek eroded its valley from the divide just west of the southwest corner of Walker County northeastward to Tennessee River and Big Wills Creek from the same divide, southwestward to Coosa River. The part of this valley lying within

Photographs by S. W. McCallie.

FALLS OF ROCK CREEK ON LOOKOUT MOUNTAIN.

the boundaries of Georgia is drained entirely by Lookout Creek, but Big Wills Creek is the larger of the two.

Lookout Creek valley is offset at Rising Fawn about the width of the valley, or a distance of 3 or 4 miles. The reason for this offset is that the valley on the northwest side of Lookout Mountain is really eroded in two anticlines instead of a single fold. The anticline that comes in from the southwest is very straight and regular and ends in Johnson Crook, a cove in the northwest side of Lookout Mountain; the anticline coming in from the northeast does not quite join that from the southwest and its termination is in Deer Head Cove, just west of Rising Fawn. A spur from Sand Mountain, known as Fox Mountain, separates the two anticlines for a short distance, but at Rising Fawn the two folds are so close that erosion has removed all trace of a dividing ridge between them.

The rocks underlying the great sandstone that forms the top of Sand Mountain and also the top of Lookout Mountain are made up of alternating beds of limestone and shale, with here and there a bed of more resistant sandstone or quartzite. Wherever these hard beds appear at the surface they form ridges or mountains which serve to break the regularity and monotony of the valleys, or plains, as they rightfully should be called. In Lookout and Wills valleys the rocks are turned up rather sharply on the flanks of the anticlines and the upturned edges of the hard beds form long lines of knobs or ridges that in place are absolutely straight for 20 or 30 miles. The contour map shown in Plate XL is not accurate enough to give a clear picture of these regular rows of knobs, but they are well shown on the Fort Payne map of the United States Geological Survey, which was made more recently and is more nearly up to the present standard of topographic mapping.

Similar, though not so narrow or sharp-topped, ridges occur on the surface of the plateaus, but here they generally mark the margin of the plateau which corresponds with the flank of the syncline composing it. These broad ridges or rims of the plateaus are fairly well shown on Sand Mountain, but they are best shown on the Fort Payne map which includes that part of Lookout Mountain lying to the southwest of the Georgia portion of the plateau. The reason for these ridges is that as the sandstone forming and preserving both Sand and Lookout mountains lies in the form of a trough or syncline, the bed only comes to the surface on the margins of the plateaus and there it is apt to form low ridges because it is so hard that it was not reduced when the peneplain was developed.

That part of Lookout Plateau lying in Georgia includes the whole of Dade County and small parts of Walker and Chattooga counties. As the soil of Lookout and Sand mountains is generally thin and unproductive, agriculture is largely restricted to Lookout and Wills valleys, which are eroded in limestone and hence have a much better soil. Dade County, which includes most of the plateau province, makes a rather poor showing in agricultural products, standing in the first rank only in the growing of strawberries.

Towns and villages are largely restricted to Lookout and Wills valleys, except that in recent years many residents of Chattanooga have established homes on Lookout Mountain, which, by means of an electric trolley road, and a good auto road, has been made easily accessible. A beautiful view of the valley can be obtained from the summit of Lookout Mountain and this alone makes a trip to its top well worth while. One of the most interesting views from this point of the mountain is that of Tennessee River and the city of Chattanooga, shown in Plate XLI.

The only mining that is carried on in the plateau province of Georgia is coal-mining on the summit of Lookout Mountain, 4 or 5 miles south of the Tennessee line. The coal mined here is an excellent grade of semibituminous or "smokeless" coal, fully equal for steam-producing purposes to that of the famous Pocahontas coal of West Virginia and Virginia.

The only important railroad in this province is the line of the Southern Railway, running from Chattanooga, Tennessee, to Birmingham, Alabama, by way of Lookout and Wills valleys. In addition to this main line there is a short road to the coal mine at the head of Rock Creek.

THE GEOGRAPHIC CONTROL OF HUMAN AFFAIRS

By Laurence LaForge

GENERAL CONSIDERATIONS

In any region of such diverse topography as the State of Georgia the lives and activities of the inhabitants are profoundly affected by the topographic conditions of the part of the State in which they live and its relation in that respect to other parts of the State. The distribution and character of the population, the situation, size, and growth or decline of cities and towns, the location of railroads and main highways, the chief industries and the location of industrial centers, the districts resorted to for vacations and outings, all display a direct response to topographic control. The study of such relations and their underlying causes is one of the most interesting as well as one of the most useful phases of the investigation of the physiography of a region.

The causes of some relations of the sort are obvious, as, for example, the sparsity of population in the belt of coastal marshes, the convergence of railroads at Atlanta and Savannah, and the locations of Macon and Columbus. The reasons underlying other relations are rather obscure, although the relations themselves are unmistakable, and still others are difficult to explain by facts at present available. Many of the facts brought out by a study of the distribution of man and his activities in the State are due to a combination of topographic controls instead of a single cause.

DISTRIBUTION OF POPULATION

Some of the bulletins containing the results of the Federal Census of 1920 include maps showing the distribution of the density of the total and the rural population. These maps are drawn on a small scale with counties as the units of representation. In Georgia many of the county boundaries do not follow natural boundaries, hence a number of counties lie in more than one topographic division. Nevertheless, the maps bring out some facts of the distribution of the population that are manifestly due to topographic control, one of which has already been mentioned. The sparsest population of the State is in the coastal belt, especially in the counties with the largest proportion of swampy land. Other areas of relatively sparse population are narrow belts along the eastern and western sides of the State adjoining the valleys of Savannah and Chattahoochee rivers, respectively, and a wider belt crossing the State along the boundary between the Coastal Plain and the Central Upland. In all these areas the surface is rather hilly and the proportion of relatively level and easily cultivable land is less than elsewhere. Soil conditions also have something to do with the sparsity of settlement. Still another area of sparse population is the Highland, where the surface is much too rough and the soil too poor to support a dense population.

The counties having the greatest number of inhabitants per square mile are of course those in which the largest cities of the State are situated, and the density of population in those counties is not due to their topographic character so much as to the conditions that determined the location of the cities. The belt of densest population extends diagonally across the State somewhat north of the middle and includes nearly all the Midland Slope, with adjacent parts of the Atlanta, Greenville, and Washington plateaus. The density of population in this belt is due to a combination of circumstances, chief of which are its situation where several main trade routes intersect, where considerable water-power is developed, and where the climate is more equable than in some other parts of the State. Another belt of relatively dense population, in the central and southwestern parts of the Coastal Plain, seems to be due more to soil conditions than to topography, though both may be factors in some counties.

As is the case in many other States, some areas of relatively dense population in Georgia are due to conditions outside the State. This is especially the case in Walker County, where the density of population is well above the average of the State. Most of the people live in the northern part of the county, which is really a part of the suburban district about Chattanooga, Tenn.

The topographic control of the distribution of population is more plainly shown by the cities and towns, which are smaller and more definitely localized units and only a few of which are situated in more than one topographic district. The Census reports divide the population into urban and rural classes, including in the former all cities and towns having more than 2,500 inhabitants and in the latter not only the strictly rural population, but also all cities and towns with less than 2,500 inhabitants. In Georgia 25 per cent of the population lives in 59 cities and towns and is classed as urban, and the remaining 75 per cent is classed as rural. The cities and towns classed as urban are too few and too generally scattered throughout the State to give much indication of the topographic control of such distribution. On the map, Plate XLIII, all the cities and incorporated towns in the State that were listed in the reports of the Census of 1920 are shown, even those with less than 100 inhabitants. There are nearly 600 such places, and although they are well distributed throughout the State, no county being without any, a study of the map brings out several features of their distribution.

Perhaps the most striking feature is the distribution in topographic provinces. The number of cities and towns in the Coastal Plain and in Appalachian Georgia is almost the same, although one division includes 60 per cent and the other 40 per cent of the area of the State. The Central Upland, comprising 79 per cent of the area of Appalachian Georgia, has 250 cities and towns, 85 per cent of the number in that part of the State. Compared with the whole State the dominance of the Central Upland in this respect is even more striking, as, with only 31 per cent of the area, this province contains more than 42 per cent of the incorporated places, four-fifths of them being southeast of

Chattahoochee River, in the area already mentioned as being that of densest population in the State. The Valley, including about 5 per cent of the area of the State, has a little more than 5 per cent of the cities and towns, and the Highland, with about 3 per cent of the area, has a little less than 3 per cent of the cities and towns. The Lookout Plateau has only 2 towns, both being situated in the Lookout Valley and not on the Plateau itself.

The same facts can be stated in another way. In the State as a whole there is one city or incorporated town to about 100 square miles of area; in the different provinces this ratio ranges from one to 150 square miles in the Lookout Plateau, through one to 123 square miles in the Highland, one to 120 square miles in the Coastal Plain, and one to 90 square miles in the Valley, to one to only 73 square miles in the Central Upland. The facts of distribution brought out by these statistical statements are well shown on the map, Plate XLIII, where the greater concentration of cities and towns in the Central Upland stands out distinctly.

Another fact of distribution well displayed on the map is the association of the cities and towns with the railroads. In some considerable areas in the Coastal Plain there are no incorporated places except on the railroads, along which they are strung like beads. Such distribution is not primarily but secondarily topographic, as the location of the railroads is controlled largely by the topography. The two factors are complexly related, because, as pointed out later, the routes of the earliest railroads were determined largely by the situation of the cities then in existence, which had been largely determined by topographic conditions.

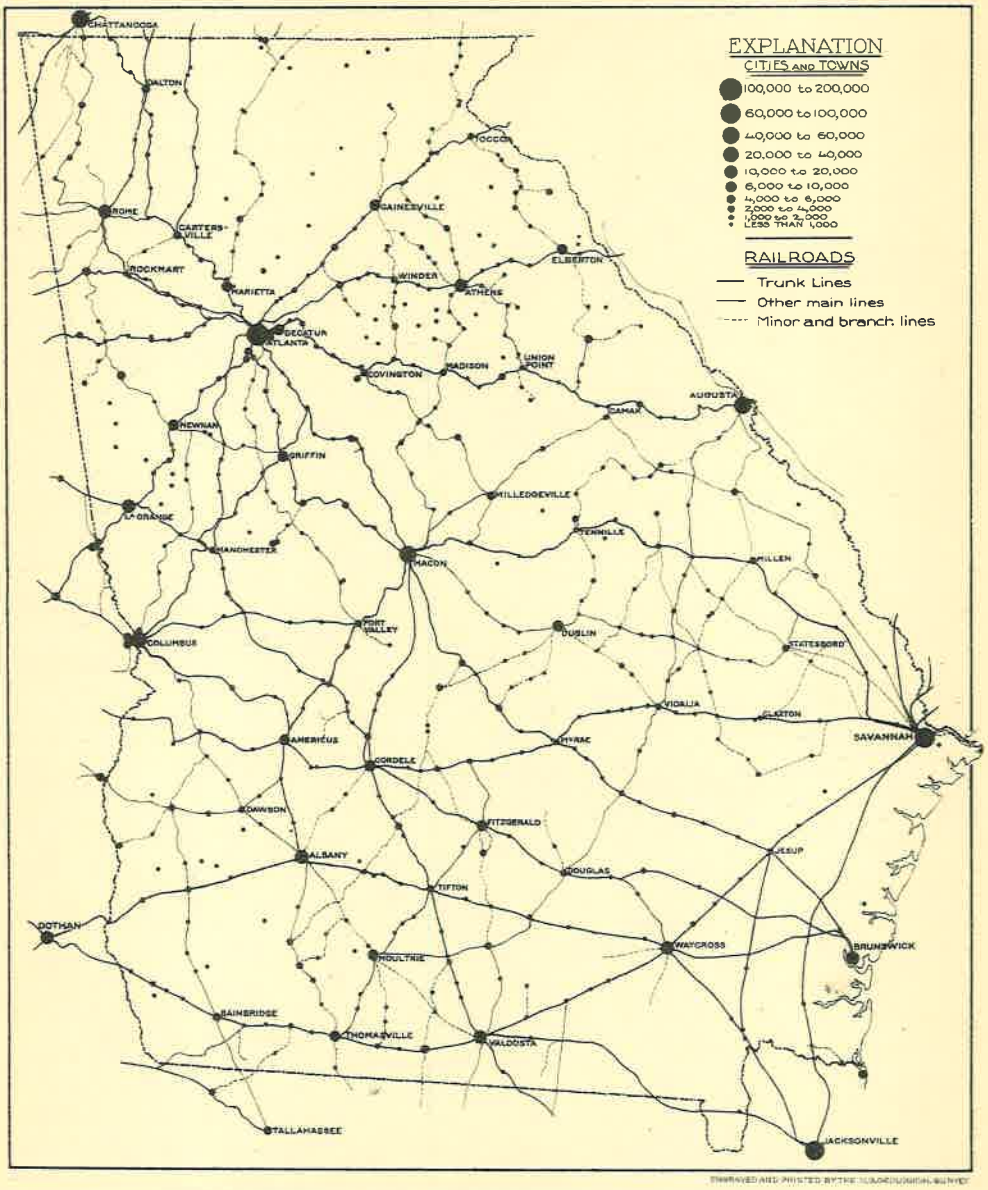
The scarcity of cities and towns in some parts of the State is also notable, especially in the part of the Coastal Plain southeast of the railroad from Savannah through Waycross and Valdosta. As already pointed out, southeast of that line is the region of coastal swamps and the least densely settled part of the State. Other areas mentioned above as having a sparse population are conspicuous on the map for their scarcity of cities and towns. In northeastern Georgia, however, the region of few cities and towns is not confined to the Highland, but extends southwestward half the length of Piedmont Georgia and into several counties that have a relatively dense population. The comparative scarcity of incorporated places in this part of the state is mainly due to the fact that it lies off the main routes of traffic and has no railroads.

Another characteristic of the distribution of the cities and towns which is not brought out by the map, because no streams are shown thereon, is the fact that so few of them, including less than a score of the more important places, are on large streams. Many of the smaller places are on streams, but many others, both large and small, are not so situated. This apparent avoidance of streams by the cities and towns is not confined to Georgia, as it is characteristic of some other parts of the southern Appalachian region. It is in rather striking contrast, however, to the conditions in most of the northern Appalachian

region, where most of the cities and towns are along the streams. It is a direct response to topographic control, as in a large part of the State the level, well drained areas, with plenty of room for future growth of population, are on the uplands and not in the valleys, which are, as a rule, narrow and with steep sides. However, special topographic conditions have caused the concentration of population at some places on the banks of large streams where cities have arisen. Macon, Augusta, and Columbus are located on large rivers primarily because of the water power developed on the rivers at those places, but also, in each case, the valley widens out at that point and the city has been built largely on a terrace that seems almost to have been put there for the purpose.

A notable feature of the map is the scarcity of smaller cities and towns in the areas surrounding several of the large cities of the State. As a rule a large city becomes surrounded with a densely settled area containing several smaller cities and large towns, the whole constituting what is sometimes spoken of as the metropolitan district of that city. Of the large cities of Georgia, only Atlanta is surrounded by such a group of satellites, and Savannah, Macon, and Augusta, in particular, are rather conspicuously surrounded by empty areas on the map. This condition is in part more apparent than real, because all three cities are in reality surrounded by zones of suburban population. As yet, however, none of the suburban towns have been incorporated and, as the map shows only incorporated places, those three large cities appear to be without suburbs. It is true, however, that all three, and Columbus also, are surrounded, outside the suburban zones, by large areas in which there are very few other cities or large towns. This is due mainly to topographic conditions. Savannah is situated between tidal marshes on one side and the estuary of Savannah River on the other side, and for miles south and southwest of the city the surface is subject to occasional inundations and there are no good town sites. Macon, Augusta, and Columbus are situated in the belt of hilly country along the boundary between the Coastal Plain and the Central Upland, where the surface is much rougher, is less adapted to attract and support a dense population, and is less suitable for town sites, than it is farther south in the Coastal Plain or farther north in the Central Upland.

The statement that the situation of cities and towns has been determined largely by topographic conditions is not universally true, as the sites of some places were determined by personal selection or even by pure accident. The subsequent growth or decline of such towns, however, is often controlled by natural conditions that were overlooked or ignored when the sites were chosen. The topographic conditions that have influenced the situation and development of cities and towns may be purely local, almost wholly regional, or a combination of the two sorts of control. Milledgeville and Porterdale, which owe their importance to water-power, Dahlonega, which is a gold-mining town, and Kirkwood, Bibb City, and Rossville, which are suburbs of large cities, are examples of topographic control by local conditions. Atlanta and Savannah are examples of control by regional conditions,



THE RAILROADS AND INCORPORATED TOWNS OF GEORGIA

and several of the larger cities of the Coastal Plain, as well as those along the Fall Line, are examples of the sort whose situation was determined by a combination of regional and local circumstances. Some suburban cities also belong in this class.

Atlanta, the Capital and largest city of the State and the metropolis of the southeastern states, is situated on the Fairburn platform of the Atlanta Plateau and on the divide between Chattahoochee and South rivers, the latter being one of the head streams of the Ocmulgee. A few miles southwest of the city the divide forks, one part continuing between Chattahoochee and Flint Rivers, the other between the Flint and the Ocmulgee. The city thus stands almost at the meeting-point of three main divides, and the metropolitan district, including the suurbs that are continuous with the city, takes in the area surrounding this junction. The local topographic conditions are thus favorable for the growth of a large city, in an area like the Central Upland, where the main routes of traffic are preferably along the divides because there the surface is smoothest and the grades are easiest. The divide separating the Chattahoochee from the southeastward-flowing streams furnishes an easy and fairly level route which extends almost across the State and which has become one of the main routes of traffic in the South.

As can be seen from the relief map, Plate XXIX-A, the main routes between the northern Atlantic cities and the eastern Gulf States must go southward around the great barrier of the Appalachian Mountains and enter Georgia from the east. The rough country extends far southward into the State and there is no easy route across it north of Etowah River. Similarly, travel between the basins of Ohio and Tennessee rivers and the southern Atlantic coast must swing southward to avoid the mountains and enters Georgia through the Appalachian Valley in the northwestern part of the State. It, too, finds no easy route across except south of Etowah River. It was stated in the description of the Atlanta Plateau that the general surface of the Plateau is lowest in its middle portion, and across this lower and smoother part lie the best routes between the Appalachian Valley and the southern coast.

There is thus a convergence of routes from the northeast, north, northwest, and west across those parts of the Central Upland where the topographic conditions are most favorable for such crossing. At the focal point, where the routes converge and cross one another, Atlanta is situated. Because of its position almost at the junction of main divides and close to the heads of Flint and South rivers, this point is also easier of access from the east, southeast, south, and southwest than almost any other point along the axis of the Central Upland. All the topographic conditions, both regional and local, therefore combine to make it the site of a metropolis such as Atlanta has become.

Many other places owe their size and importance to a similar combination of regional and local conditions. Savannah is the nearest Atlantic port, not only to the more densely settled region of the Central Upland and the chief manufacturing district of the State, but to those

parts of the Ohio and Tennessee basins that find an outlet around the southern end of the Appalachian Mountains and across Georgia. The local conditions are also favorable because the belt of coastal marshes is narrower than it is in southern Georgia, and because the estuary of Savannah River, deep enough for sea-going vessels, penetrates some distance inland. The city is at the head of deep-water navigation, but on dry land above the level of the coastal marshes.

Macon, Augusta, and Columbus are situated where Ocmulgee, Savannah, and Chattahoochee rivers, respectively, cross the Fall Line. They owe their growth only in part to the development of water-power, as each city is at the head of navigation on that river, and each is at a point which some main route of traffic finds the most advantageous for crossing the stream. The head of navigation on Flint River is at Albany, miles below where that stream crosses the Fall Line. Brunswick is the nearest Atlantic port to a large part of the Coastal Plain in Georgia and is the most accessible Atlantic port to a great part of the eastern Gulf region. Some of the larger inland cities of the Coastal Plain owe their growth largely to the fact of their situation at the points of intersection of several railroads converging on Savannah, Brunswick, and Jacksonville.

In Appalachian Georgia, Rome is situated in one of the richest parts of the Valley, where Etowah and Oostanaula rivers unite to form Coosa River. Toccoa, Gainesville, Buford, Fairburn, Newnan, and LaGrange are situated along the railroad that traverses the main divide to which frequent reference has been made. Mention might be made of numerous other places in the State that owe their location or their importance to topographic conditions, but to do so would be merely to multiply examples. Those already enumerated suffice to illustrate the different ways in which topography exerts an influence upon the situation, growth, and general character of a city.

TRAFFIC ROUTES

The influence of topographic conditions upon the location of lines of traffic has already been mentioned and illustrations have been given. As with the location and growth of cities, the influence of topography upon the location of routes is partly regional and partly local. The main trade routes of the country connect important centers or districts of production with those of consumption or export. Their general courses and locations depend, therefore, on conditions far outside the borders of some of the States that they cross. Their detailed courses and locations, on the other hand, depend largely on local conditions. The minor routes, that connect cities in the State with one another or with those in neighboring States, are not so much influenced by regional conditions, but may be more influenced by local topography, as the shortest route between terminal points is not such an important consideration in their construction.

The railroads of the State of Georgia may, therefore, be included in three groups: the trunk lines, that connect the chief commercial centers of the State with those of neighboring States, or that traverse Georgia in connecting such centers in other States; other main lines, such as those that connect the chief cities within the State but carry little interstate traffic; and the minor and branch lines, of relatively small importance in the main scheme.

The earliest railroads were built to connect one city with another and naturally took the most direct routes that were feasible. Their general courses were not determined by the topography, except for the necessity of avoiding mountainous districts and areas of great swamps and of crossing large rivers at points where bridges would not be too expensive. In those early days, however, construction costs were given more consideration than operation costs and the making of deep cuts and high fills and the building of long bridges and tunnels were avoided wherever possible, even if such a course resulted in a crooked route and heavy grades. In detail, therefore, the courses of the early railroads were controlled almost throughout by the topography and they followed divides or valley bottoms for miles. Good examples of this sort of control are the route of the Georgia Railroad between Atlanta and Augusta, that of the Western and Atlantic between Atlanta and Cartersville, and that of the Southern Railway between Atlanta and Rome. Some of the earlier roads in the Coastal Plain, also, especially in the eastern part, have rather devious courses, determined largely by the topography. The later railroads in the Coastal Plain, particularly in the southeastern part of the State, cross a region with a comparatively smooth surface on which they ignore the minor details of the topography and take direct courses from city to city.

In modern railroad building more attention is paid to future operation costs than to construction costs and, in order to save distance and to avoid numerous curves and heavy grades, much money is spent in cutting and filling and in building bridges and tunnels. Such roads thus have fairly direct courses and easy grades, in spite of the topography, which they overcome, hence the routes adopted by them show only a moderate amount of topographic control. The difference between a route laid out in this manner and one laid out in the old way is well shown by comparison of the new line of the Seaboard Air Line between Atlanta and Rockmart with the old line of the Southern Railway between the same points. The two are nowhere more than a few miles apart, but the former is noticeably more direct and has much easier grades.

With the growth of railroads throughout the country many of the short lines that had been built mainly to connect one city with another not far away were linked up in systems extending through many States and including trunk lines joining cities perhaps a thousand miles apart. Several such trunk lines cross Georgia, connecting New York and other large cities of the Northeast with Florida and the Gulf coast and con-

necting Chicago and other large cities of the Middle West with Florida and the southern Atlantic coast. As such trunk lines primarily connect cities far outside the State, their locations within the State are not affected by its topography, except in a broad way. Some of them swing far enough south to avoid the Appalachian Mountains and others keep far enough inland to avoid the coastal marshes, but otherwise they pay little attention to the general topography. Some trunk lines cross the State merely because it lies between their terminals but they have no close relation to the railroad system of the State as such. A good example of such a line is the branch of the Southern Railway that connects Chattanooga with Birmingham and which traverses the length of Dade County, but is of little importance in the transportation system of the State. Another is the branch of the Seaboard Air Line which traverses the length of the Georgia seaboard from Savannah to Jacksonville without passing through any important town between those two cities.

Another way in which the routes of some railroads in Georgia are controlled by conditions outside the State rather than by its topography is shown by the convergence of railroads within the State upon large cities in neighboring States. This is shown by the map, Plate XLIII, which includes the locations of Chattanooga and Jacksonville and the railroads running from points in Georgia to those cities. There are similar convergences of railroads from points in Georgia upon Birmingham and Montgomery, but not enough of Alabama is included in the map to make this entirely plain. On the side of the State toward South Carolina the conditions are reversed, for there is no convergence of railroads from Georgia points upon any South Carolina city, but there is such a convergence from points in South Carolina upon Savannah. The map includes too little of South Carolina to show this well.

The map, Plate XLIII, shows all the railroads in the State that were known to be in operation at the end of 1924. Trunk roads, which carry through traffic to and from points outside the State, are shown by heavy full lines, and other main roads by lighter full lines. Relatively unimportant and branch roads are shown by dashed lines. Several notable features of the railroad system of the State are brought out by the map. The concentration of roads upon half a dozen of the large cities, the greater number of cross lines and branch lines in the parts of the State where cities and towns are most abundant, the absence of any but trunk lines in the southeastern part of the Coastal Plain, and the lack of any roads in some parts of the State, are all well shown.

There are eight counties without a railroad and a ninth is entered by a railroad only at its margin. Of the eight without railroads, only one is in the Coastal Plain, and six form a contiguous group in the Highland and the adjacent part of Piedmont Georgia, extending to within a few miles of Atlanta. This part of the State has strong relief, is off the main lines of traffic, and contains no important towns.

Large areas in the Coastal Plain, crossed by no railroads other than trunk lines, are mainly forested or else are within the dominantly swampy area. The association of the towns with the railroads, already mentioned, is well shown. In large parts of the Coastal Plain there are no towns except along the railroads. On the other hand, in some parts of the Midland Slope and the Washington Plateau there are a number of towns not on any railroads, though railroads are not lacking in those areas.

INDUSTRIES AND TRADE

The influence of topography upon the means by which the people of a State gain a livelihood is not less distinct than its influence on settlement and transportation. The same general principles apply in nearly all regions, and conditions are not greatly different in this regard in Georgia from those elsewhere. As in most States, the chief occupation is tilling the soil, not alone the raising of food stuffs, but also the cultivation of crops used primarily in manufacturing. Agriculture is influenced as much by soil and by climatic conditions as by topography, but topography may be the controlling factor where other things are equal. This is notably true in parts of the Coastal Plain and the Central Upland where the soils and climatic conditions are essentially the same as in neighboring areas, but where the surface is so rough and so much of it is in steep slopes that much of the land is uncultivated. Again, in regions like the southeastern part of the Coastal Plain, where the surface is so level that it is not well drained, agriculture is not ordinarily profitable, unless devoted to crops adapted to such conditions. In general, then, the chief agricultural districts of the State are the broad valleys and the rolling uplands. The mountainous districts, the rough ridges, the steep slopes bordering the deeper valleys, and the swamps, are not generally cultivated.

Much the same principles apply to the influence of topography on the manufacturing industries and on the character of the local commercial industries, both of which may be influenced chiefly by other than topographic conditions. The manufacture of such things as lumber and clay products is confined mainly to the districts in which they are abundant or are easily available, where topography may not be the controlling factor. The manufacture of cotton products and the like, however, is usually concentrated in districts where water power or fuel is easily obtained. The manufacturing districts of Georgia are confined largely to the densely settled belt in the Midland Slope and the adjacent part of the Atlanta Plateau and to the large cities along the Fall Line. The mineral products of the State, aside from clay products and those that are marketed in or near the localities of production, are mainly of the sort that bear transportation in bulk as raw material and can be shipped at low rates. Hence they are generally sent out of the State for manufacture, and there is little relation between the mineral industry of the State and its topography.

APPENDIX

ALTITUDES

Throughout Georgia numerous elevations have been established at various points by the United States Geological Survey, United States Army Engineers, and the engineering departments of various railroads. Using these elevations as a base the Geological Survey of Georgia has established the elevation of numerous other points by repeated checking with aneroids or by the joint use of a barograph and aneroid barometers. The limit of error of the elevations thus established is probably less than 10 feet.

ALTITUDES IN GEORGIA

TOWN	AUTHORITY	ELEVATION
Aaron	U. S. G. S.	260
Abbeville (Court House)	Aneroid	255
Abbeville low water	U. S. A. Eng.	169.33
Acree, Dougherty Co.	A. C. L.	205
Acworth	W. & A. R. R.	915
Adairsville	W. & A. R. R.	708
Adairsville	Weather Bureau	772
Adam Knob	U. S. G. S.	3,588
Adams Park	U. S. G. S.	259
Adel	G. S. & F. Rwy	246
Adrian, Emanuel Co.	Rough est.	290
Aerial	U. S. G. S.	1,478
Ailey	Aneroid	250
Akes	S. A. L.	818
Alamo	Aneroid	245
Alapaha	A. C. L.	293
Albany	A. C. L.	184
Albany River Level	A. C. L.	127
Albany bridge	Aneroid	175
Alcova Mountain	U. S. C. & G. S.	1,090
Alcovy	G. R. R.	707
Alexander	U. S. G. S.	283
Alexanderville	A. C. L.	153
Allatoona	W. & A. R. R.	866
Allenhurst	U. S. G. S.	60
Allentown	M. D. & S.	411?
Alma	Aneroid	195
Alpine	U. S. G. S.	770
Alto	S. Rwy	1,404
Alton	S. A. L.	759
Ambrose, Coffee Co.	Aneroid	280
Americus	C. of Ga. Rwy	360
Amoskegag	S. Rwy	339
Andersonville	C. of Ga. Rwy	394
Angel	S. A. L.	592
Anguilla	U. S. G. S.	10
Anniedelle	U. S. G. S.	596

TOWN	AUTHORITY	ELEVATION
Antioch	U. S. G. S.	745
Appling	U. S. G. S.	263
Arabi	G. S. & F. Rwy	460
Arcola	U. S. G. S.	125
Argyle	A. C. L.	161
Arlington	Rough est.	275
Armena	S. A. L.	275
Armuchee	U. S. G. S.	618
Asbury	U. S. G. S.	691
Ashburn	G. S. & F. Rwy	450
Athens	S. A. L.	662
Athens	G. R. R.	680
Athens	S. Rwy	705
Athens	Weather Bureau	694
Atkinson	U. S. G. S.	68
Atlanta, Union Station	U. S. G. S.	1,032
Atlanta, B. M. on capitol bldg.	U. S. G. S.	1,050
Atlanta, tower of capitol	U. S. C. & G. S.	1,163
Atlanta	Weather Bureau	1,174
Atlanta Junction, S. Rwy	U. S. G. S.	606
Attapulgus	G. F. & A.	175
Auburn	S. A. L.	1,307
Augusta, Union Station	City engineer	143
Augusta, low water	U. S. G. S.	109
Augusta, river gage	Weather Bureau	100
Augusta	Weather Bureau	180
Austell, S. Rwy	U. S. G. S.	927
Autreyville	Aneroid	315
Avondale	G. S. & F. Rwy	360
Ayersville	S. Rwy	1,253
Baconton	A. C. L.	160
Bainbridge	A. C. L.	110
Bainbridge, water level	G. F. & A.	68
Bainbridge	Weather Bureau	119
Baldwin	S. Rwy	1,490
Bankston	S. Rwy	359
Barnesville	C. of G. Rwy	859
Barnett	G. R. R.	633
Bartow	C. of G.	237
Bartow	W. & A. R. R.	833
Barwick	Aneroid	235
Bascom	U. S. G. S.	118
Bath, Richmond Co.	Rough est.	400
Baxley	U. S. G. S.	206
Baxter	U. S. G. S.	117
Beachton	Aneroid	260
Bealwood	C. of G. Rwy	387
Bear Den Mountain	U. S. G. S.	4,072
Beasley Knob, Union County	U. S. G. S.	2,940
Beatty switch, S. Rwy	U. S. G. S.	927
Belair	G. R. R.	295
Bell Knob	U. S. G. S.	3,457
Bell Mountain, Towns Co.	U. S. G. S.	3,446
Belleville	U. S. G. S.	185
Belt Junction	S. A. L.	922
Benefit	U. S. G. S.	1,429
Berner, S. Rwy	U. S. G. S.	394
Berry	S. Rwy	453
Berzelia	Ga. R. R.	488

TOWN	AUTHORITY	ELEVATION
Bests	W. & A. R. R.	746
Big Bald, Gilmer Co.	U. S. G. S.	4,120
Black Mountain, Dawson & Gilmer Co.	U. S. G. S.	3,600
Blackshear	A. C. L.	106
Blackwell	L. & N. Rwy	964
Bladen	U. S. G. S.	16
Bladen	S. A. L.	22
Blairsville	U. S. G. S.	1,926
Blakely	Rough est.	275
Blanford	U. S. G. S.	79
Blanton	G. S. & F. Rwy	172
Blood, Mount, Lumpkin & Union Co.	U. S. G. S.	4,463
Bloomingdale	C. of G. Rwy	24
Blue, Mount, Towns Co.	U. S. G. S.	4,045
Blue Ridge	L. & N. Rwy	1,760
Blue Rock, Union Co.	U. S. G. S.	3,340
Bogart	S. A. L.	804
Bolingbroke	C. of G. Rwy	567
Bolton	W. & A. R. R.	833
Bonaire	G. S. & F.	354
Boston	A. C. L.	194
Bostwick (Paschal)	C. of Ga.	669
Boulogne, Fla.	U. S. G. S.	59
Bowersville	S. Rwy	934
Bowdon	U. S. G. S.	1,085
Bowman	S. Rwy	798
Box Springs	U. S. G. S.	364
Braganza	A. C. L.	144
Brasstown	U. S. G. S.	2,218
Brasstown Bald (Mount Enota)	U. S. G. S.	4,798
Brasstown Gap, Union Co.	U. S. G. S.	2,224
Brasswell, S. Rwy	U. S. G. S.	1,056
Brasswell south switch	U. S. G. S.	1,062
Brasswell, B. M. on tunnel	U. S. G. S.	1,088
Brawley, Mount, Fannin Co.	U. S. G. S.	3,031
Bremen	S. Rwy	1,403
Brentwood	U. S. G. S.	167
Brewer	C. of G. Rwy	118
Brice, S. Rwy	U. S. G. S.	824
Brinson	A. C. L.	104
Broadhurst	U. S. G. S.	56
Brookfield	A. C. L.	332
Brooklet	U. S. G. S.	159
Brooklyn	S .A. L.	691
Brown	C. of G. Rwy	369
Broxton	Aneroid	265
Browntown	U. S. G. S.	70
Brunswick	Sou. Ry.	13
Brunswick City Hall	U. S. G. S.	11
Buchanan	U. S. G. S.	1,295
Buck Gap	U. S. G. S.	3,697
Buckhead	G. R. R.	612
Buck Mountain, Towns Co.	U. S. G. S.	3,260
Buena Vista	Rough est.	590
Buford	S. Rwy	1,205
Bullard	U. S. G. S.	259
Burnt Mountain	U. S. G. S.	3,251
Burroughs	A. C. L.	19
Bushnell	Rough est.	260
Butler	C. of Ga.	650

TOWN	AUTHORITY	ELEVATION
Buzzards Roost, Union Co.	U. S. G. S.	3,653
Byrd, S. Rwy	U. S. G. S.	862
Byromville	A. B. & A.	365
Byron	C. of Ga.	515
Cadwell	Aneroid	345
Cairo	A. C. L.	237
Calhoun	U. S. G. S.	716
Camak	Ga. R. R.	578
Camak	Weather Bureau	613
Cameron	U. S. G. S.	102
Camilla	A. C. L.	167
Camp	G. R. R.	243
Cannonville	A. & W. P. R. R.	652
Canoochee	S. & S.	372
Canton	Weather Bureau	894
Carbondale, S. Rwy	U. S. G. S.	762
Carling	U. S. G. S.	403
Carlton	S. A. L.	557
Carne	S. Rwy	372
Carnes, Mount	U. S. G. S.	1,291
Carnesville	U. S. G. S.	700
Carrollton	U. S. G. S.	1,095
Carrs Station	U. S. G. S.	500
Cartersville	W. & A. R. R.	748
Cass	W. & A. R. R.	754
Cataula	C. of G. Rwy	692
Catoosa	W. & A. R. R.	778
Cave Spring	S. Rwy	662
Cecil	G. S. & F. Rwy	250
Cedarcliff Mount, Towns Co.	U. S. G. S.	3,391
Cedar Mountain	U. S. G. S.	2,915
Cedartown	S. A. L. Rwy	817
Cedartown	Weather Bureau	850
Cement	W. & A. R. R.	673
Center	S. Rwy	861
Centerside	U. S. G. S.	1,446
Centralhatchee	U. S. G. S.	849
Ceylon	U. S. G. S.	18
Chalker	Aneroid	330
Chambers	U. S. G. S.	704
Chamblee	S. Rwy	1,037
Charleston, A. C. L.	U. S. G. S.	709
Charlie, Mount, Rabun Co.	U. S. G. S.	3,034
Chattahoochee, S. Rwy	U. S. G. S.	809
Chauncey	U. S. G. S.	300
Cheney	C. of G. Rwy	1,035
Cherry Log	L. & N. Rwy	1,548
Chestnut, Mount, Rabun Co.	U. S. G. S.	4,600
Chestnut Cove, Mount, Union Co.	U. S. G. S.	3,156
Chimney, Mount, Habersham Co.	U. S. G. S.	3,446
Chimneytop, Mount, Union Co.	U. S. G. S.	4,229
Chipley	U. S. G. S.	923
Chula	G. S. & F. Rwy	395
Clarkston	G. R. R.	998
Clarkesville, T. F. Rwy	U. S. G. S	1,363
Claxton	U. S. G. S.	187
Clayton	Weather Bureau	2,100
Cleveland	U. S. G. S.	1,552
Clifton	C. of G. Rwy	22

TOWN	AUTHORITY	ELEVATION
Climax	A. C. L.	277
Clyo	U. S. G. S.	72
Coal City	S. A. L. Rwy	569
Cochran	U. S. G. S.	342
Cohutta	U. S. G. S.	867
Colebrook, Effingham Co.	Brinson R. R.	65
Coleman	C. of Ga.	391
Colesburg	U. S. G. S.	20
Coley	S. Rwy	303
College Park	A. & W. P. R. R.	1,049
Collier	C. of G. Rwy	730
Collins	S. A. L.	238
Colman	C. of G. Rwy	391
Colon	G. S. & F.	137
Colquitt	Rough est.	175
Columbus	U. S. G. S.	250
Columbus	Weather Bureau	262
Comak	G. R. R.	578
Comer	S. A. L.	573
Como	S. A. L. Rwy.	865
Commerce	S. Rwy	965
Conley, S. Rwy	U. S. G. S.	850
Connally	C. of G. Rwy	994
Constitution	U. S. G. S.	848
Conyers	G. R. R.	880
Cooper Gap	U. S. G. S.	2,847
Coosa Bald, Union Co.	U. S. G. S.	4,287
Cordele, Union Station	G. S. & F. Rwy.	336
Cork	U. S. G. S.	544
Cornelia	S. Rwy	1,537
Covington	G. R. R.	734
Covington	Weather Bureau	800
Coweta	A. & W. P. R. R.	979
Cowpen Mountain	U. S. G. S.	4,165
Cowrock, Mount, Lumpkin Co.	U. S. G. S.	3,867
Cox, S. Rwy	U. S. G. S.	287
Crawfordville	G. R. R.	589
Culverton	G. R. R.	549
Cumming	U. S. G. S.	1,316
Cunningham	S. Rwy	675
Currahee Mountain	U. S. C. & G. S.	1,740
Cuseta	U. S. G. S.	540
Cushingville	C. of G. Rwy	153
Cuthbert	C. of G. Rwy	446
Cutler	G. S. & F. Rwy	78
Cuyler	S. A. L.	37
Cycloneta	G. S. & F. Rwy	410
Dacula	S. A. L.	1,038
Dademont	A. G. S. R. R.	821
Dahlonega	U. S. C. & G. S.	1,519
Dahlonega	Weather Bureau	2,230
Daisy	U. S. G. S.	177
Dakota	G. S. & F. Rwy	410
Dales Mill	A. C. L.	136
Dallas	U. S. G. S.	1,003
Dalton	U. S. G. S.	759
Dames Ferry	U. S. G. S.	346
Darien	Rough est.	15
Dasher	G. S. & F. Rwy	185

TOWN	AUTHORITY	ELEVATION
Davis	A. C. L.	238
Davisboro	C. of Ga.	302
Dawson	C. of Ga. Rwy	352
Days Gap	S. Rwy	333
Dearing	Ga. R. R.	464
Decatur	Ga. R. R.	1,019
Demorest	U. S. G. S.	1,469
Dempsey	S. Rwy	376
Denmark	U. S. G. S.	182
Devereux	U. S. G. S.	577
Dewitt	Butts Map	175
Diamond	Weather Bureau	2.020
Dixie	A. C. L.	130
Dock Junction	U. S. G. S.	25
Doctortown	A. C. L.	74
Doerun	Aneroid	425
Doles	Aneroid	260
Dome Mountain	U. S. C. & G. S.	4,042
Don, S. Rwy	U. S. G. S.	913
Donald	U. S. G. S.	83
Donaldsonville	A. C. L.	139
Dooling	A. B. & A. Rwy	270
Doraville	S. Rwy	1,057
Double Knob, Towns Co.	U S. G. S.	4,052
Double Run	A. B. & A. Rwy	250
Doubletop, White Co.	U. S. G. S.	3,155
Dougherty Gap	U. S. G. S.	1,655
Douglas	A. B. & A. Rwy	275
Douglasville	S. Rwy	1,215
Dover	U. S. G. S.	103
Draketown	U. S. G. S.	1,287
Dry Branch	M. D. & S.	368?
Dublin	U. S. A. Eng.	106.6
Duboi	S. Rwy	391
Dudley	M. D. & S.	325?
Duluth	S. Rwy	1,105
Dunbarton	U. S. G. S.	251
Duncan Bridge, Habersham Co.	U. S. G. S.	1,154
Dupont	A. C. L.	180
Eagle Mount, Towns Co.	U. S. G. S.	4,280
East Albany	A. C. L.	186
Eastburn	U. S. G. S.	1,335
Eastman	U. S. G. S.	357
East Macon	G. R. R.	297
East Point	C. of G. Rwy	1,046
East Rome	U. S. G. S.	611
Eden	C. of G.	34
Egypt	U. S. G. S.	133
Elberton	S. Rwy	708
Eldorado	G. S. & F. Rwy	340
Elizabeth	W. & A. R. R.	1,150
Elko	G. S. & F. Rwy	443
Ellabelle	S. A. L.	93
Ellaville	Aneroid	555
Ellen, S. Rwy	U. S. G. S.	894
Ellenwood	U. S. G. S.	848
Ellijay	L. & N. Rwy	1,312
Emerson	W. & A. R. R.	830
Emmalane	U. S. G. S.	207

TOWN	AUTHORITY	ELEVATION
Empire	U. S. G. S.	382
Enigma	A. C. L.	309
Enota Mountain (Brasstown Bald)	U. S. G. S.	4,798
Esom	A. B. & A. Rwy	905
Esquilline	U. S. G. S.	300
Estes	U. S. G. S.	782
Etna	S. Rwy	870
Eufaula	C. of G. Rwy	211
Evansville	U. S. G. S.	684
Everett City	U. S. G. S.	16
Everett Station, Crawford Co.	C. of Ga.	337
Exeter	A. C. L.	94
Exley	S. A. L.	63
Faceville	A. C. L.	296
Fairmont		800
Fairburn	A. & W. P. R. R.	1,030
Falls Mountain, Rabun Co.	U. S. G. S.	1,900
Fargo	G. S. & F. Rwy	116
Fayette	S. Rwy	359
Fellowship Church	S. Rwy	857
Fendig	U. S. G. S.	84
Findlay	G. S. & F. Rwy	390
Fish	A. B. & A. Rwy	804
Fish Trap tunnel	S. Rwy	361
Fitzgerald	A. B. & A. Rwy	275
Fitzgerald	Aneroid	350
Fitzpatrick	M. D. & S.	541
Five Forks	S. A. L.	733
Fleming	A. C. L.	22
Flint	A. C. L.	168
Flippin, S. Rwy	U. S. G. S.	861
Florilla, S. Rwy	U. S. G. S.	588
Flowery Branch	S. Rwy	1,112
Floyds	A. B. & A. Rwy	1,012
Fodder Bald Mountain	Guyot	4,821
Folkston	U. S. G. S.	81
Forest, Clinch Co.	A. C. L.	166
Forest Fayette Co.	A. C. L.	998
Forrest, Clayton Co.	G. R. R.	497
Forsyth	C. of G. Rwy	704
Fort Gaines	C. of G. Rwy	163
Fort Gaines	Weather Bureau	166
Fort Gaines	Aneroid	215
Fort McPherson	C. of G. Rwy	1,045
Fort, Mount	U. S. G. S.	2,827
Fort Mudge	A. C. L.	134
Fortson	C. of G. Rwy	522
Fort Valley	C. of G. Rwy	525
Fortville	G. R. R.	471
Fouche	U. S. G. S.	728
Fowlstown	A. C. L.	289
Franklin	U. S. G. S.	696
Frankville	S. Rwy	393
Frozen Knob, Union Co.	U. S. G. S.	3,489
Frozentop, Union Co.	U. S. G. S.	3,190
Gabbettville	A. & W. P. R. R.	609
Gainesville	S. Rwy	1,200
Gainesville	Weather Bureau	1,254
Gallemore	M. D. & S.	394?

TOWN	AUTHORITY	ELEVATION
Gammage	C. of G. Rwy	1,046
Gardi	U. S. G. S.	62
Garfield	G. & F.	287
Garland	U. S. G. S.	1,450
Geneva	U. S. G. S.	581
Georgetown	C. of G.	189
Gillionville	Aneroid	245
Gillsville	S. Rwy	1,063
Gillsville	Weather Bureau	1,052
Gilmore	W. & A. R. R.	885
Girard	U. S. G. S.	241
Glassy Knob, Towns Co.	U. S. G. S.	3,650
Glassy Mountain, Rabun Co.	U. S. G. S.	3,521
Glencoe	U. S. G. S.	20
Glenmore	A. C. L.	151
Glenville	U. S. G. S.	175
Glenwood	Aneroid	195
Gloster	S. A. L.	868
Gober	L. & N. Rwy	1,000
Godwinsville	U. S. G. S.	312
Goggins	C. of G. Rwy	790
Gordon	C. of G. Rwy	348
Goshen, Mount	U. S. G. S.	2,923
Goss	S. Rwy	729
Gough	U. S. G. S.	394
Graham	U. S. G. S.	244
Grangerville	U. S. G. S.	80
Grantville	A. & W. P. R. R.	869
Grassy Knob, Towns Co.	U. S. G.S	3,196
Grassy Knob, Union Co.	U. S. G. S.	4,768
Grassy Mountain	U. S. C. & G. S.	3,290
Graves	C. of G.	350
Grays	A. C. L.	232
Graysville	W. & A. R. R.	700
Greensboro	G. R. R.	598
Greens Cut	U. S. G. S.	276
Greenville	C. of G. Rwy	447
Gregory Knob, Union Co.	U. S. G. S.	3,480
Gresston	U. S. G. S.	401
Griffin	C. of G. Rwy	965
Grimshaw	U. S. G. S.	180
Grimes Nose, White Co.	U. S. G. S.	1,959
Griswold	C. of G. Rwy	447
Grovania	G. S. & F. Rwy	444
Groveland	U. S. G. S.	158
Grovetown	Ga. R. R.	495
Gulf, Mount	U. S. G. S.	2,074
Gumlog Mountain, Union Co.	U. S. G. S.	3,743
Guyton	C. of G. Rwy	81
Hagan	U. S. G. S.	190
Hahira	G. S. & F. Rwy	230
Halycondale	C. of G. Rwy	110
Halloca	U. S. G. S.	323
Halls	W. & A. R. R.	774
Hamilton	C. of G. Rwy	786
Hamlet	S. Rwy	746
Hampton	C. of G. Rwy	885
Hapeville	C. of G. Rwy	1,000
Hardage	S. A. L.	1,044

TOWN	AUTHORITY	ELEVATION
Hardaway	A. C. L.	183
Harlem	G. R. R.	548
Harper	U. S. G. S.	678
Harris, Mount, Towns Co.	U. S. G. S.	3,282
Harrison	Aneroid	400
Hartwell	U. S. G. S.	838
Hatcher	C. of G.	289
Hatley	A. B. & A. Rwy.	305
Hawkinsville	Weather Bureau	235
Haylow	G. S. & F. Rwy.	167
Hazlehurst	U. S. G. S.	256
Headlight	G. S. & F. Rwy.	144
Heardmont	S. A. L.	530
Heds Ferry, White Co.	U. S. G. S.	1,108
Helena	U. S. G. S.	247
Heltons Field, White Co.	U. S. G. S.	1,727
Hematite	S. Rwy.	746
Hemptown Gap	U. S. G. S.	2,197
Henrico	U. S. G. S.	863
Hepzibah	Weather Bureau	402
Herndon	C. of Ga. Rwy.	179
Hickory Nut Mountain	U. S. G. S.	2,060
Hickox	U. S. G. S.	65
Higgston	Aneroid	298
High Point	U. S. G. S.	2,408
High Top, Union Co.	U. S. G. S.	3,462
Hightower Bald, Towns Co.	U. S. G. S.	4,567
Hilltonia	U. S. G. S.	215
Hines	C. of G. Rwy.	592
Hinesville	U. S. G. S.	78
Hiram	U. S. G. S.	960
Hiwassee	U. S. G. S.	1,963
Hogansville	A. & W. P. R. R.	715
Holton	U. S. G. S.	339
Homeland	U. S. G. S.	88
Homer	U. S. G. S.	831
Homerville	A. C. L.	176
Hood, Union Co.	U. S. G. S.	2,016
Hooker	U. S. C. & G. S.	863
Hooper	S. Rwy.	943
Horse Creek	S. Rwy.	283
Horse Leg, Mount	U. S. G. S.	437
Horse Trough, Union Co.	U. S. G. S.	4,052
Hortense	U. S. G. S.	56
Howard	C. of Ga.	666
Howell, Echols Co.	G. S. & F. Rwy.	169
Howell, Fulton Co.	S. Rwy.	968
Hubert	U. S. G. S.	103
Hull	S. A. L.	792
Idlewood	U. S. G. S.	294
Inaha	G. S. & F.	415
Irwinton	U. S. G. S.	448
Isabella	A. C. L.	370
Ivanhoe	U. S. G. S.	93
Ivy Log Church	U. S. G. S.	1,932
Jacks Knob, Towns Co.	U. S. G. S.	4,011
Jackson, S. Rwy.	U. S. G. S.	697
Jamacia	A. C. L.	21
Jasper, Fla.	A. C. L.	152

TOWN	AUTHORITY	ELEVATION
Jay	U. S. G. S.	1,347
Jakin	A. C. L.	140
Jefferson	U. S. G. S.	600?
Jeffersonville	M. D. & S.	526
Jenkinsburg	U. S. G. S.	766
Jennie	U. S. G. S.	185
Jerusalem	U. S. G. S.	17
Jesup	U. S. G. S.	100
Johnson	C. of G. Rwy.	254
Johnsonville	S. Rwy.	240
Johnston	A. C. L.	71
Jonesboro	C. of G. Rwy.	917
Juliette	U. S. G. S.	376
Junction	A. C. L.	210
Junction	C. of G. Rwy	484
Juniper Sta.	U. S. G. S.	422
Kartel	U. S. G. S.	688
Kathleen	G. S. & F. Rwy	330
Keithsburg	L. & N. Rwy.	1,040
Kelly, Mount, Union Co.	U. S. G. S.	2,522
Kelly Ridge, Towns Co.	U. S. G. S.	4,288
Kennedys Mill	S. Rwy	291
Kennesaw	W. & A. R. R.	1,093
Kennesaw, Mount	U. S. C. & G. S.	1,809
Keysville	U. S. G. S.	280
Kibbee	Aneroid	322
Kildare	U. S. G. S.	129
Kimbrough	U. S. G. S.	558
Kimsey	C. of G. Rwy.	991
Kimsey, Mount, White Co.	U. S. G. S.	1,502
Kingsboro	C. of G. Rwy.	612
Kingsland	S. A. L.	41
Kingston	W. & A. R. R.	700
Kirkland	A. C. L.	236
Kittrels	Aneroid	350
Knotts	C. of G. Rwy	1,036
Knoxville	J. E. Thomas	640
Lafayette	U. S. G. S.	871
LaGrange	A. & W. P. R. R.	729
LaGrange	U. S. G. S.	786
Lake Park	G. S. & F. Rwy	160
Lambert	U. S. G. S.	92
Lanier	U. S. G. S.	70
Lavender	U. S. G. S.	684
Lavinia	S. Rwy	867
Lavonia	U. S. G. S.	865
Lawrenceville	S. Rwy	1,082
Lawton	U. S. G. S.	219
Leadpole, Mount	U. S. G. S.	2,206
Leaf	U. S. G. S.	1,435
Leary	D. L. Wardroper	210
Lee Pope	Aneroid	522
Leesburg	Aneroid	282
Lela	A. C. L.	146
Leliaton	Aneroid	245
Leland	U. S. G. S.	141
Lemons Gap	U. S. G. S.	4,148
Lenox	G. S. & F. Rwy	300
Lenox, Mount	U. S. G. S.	797

TOWN	AUTHORITY	ELEVATION
Leo	U. S. G. S.	1,430
Letford	U. S. G. S.	62
Levelland, Mount	U. S. G. S.	3,942
Lewiston	C. of G. Rwy	385
Lexington	G. R. R.	756
Licklog Mountain	U. S. G. S.	3,432
Lida	U. S. G. S.	95
Lilburn	S. A. L.	876
Lily	A. B. & A. Rwy	251
Linconlton	U. S. G. S.	500
Lindale	S. Rwy	651
Lithia Springs	S. Rwy	1,054
Lithonia	G. Rwy	923
Little Bald Mountain	U. S. G. S.	4,055
Locust Grove	U. S. G. S.	837
Loganville	S. A. L.	1,000
Long	U. S. G. S.	734
Long Pond, Hancock Co.	U. S. G. S.	66
Longstreet	U. S. G. S.	302
Lorenzo	U. S. G. S.	100
Loudsville	U. S. G. S.	1,683
Louise	A. & W. P. R. R.	723
Louisville	U. S. G. S.	337
Lovejoy	C. of G. Rwy	954
Ludowici	A. C. L.	71
Lula	S. Rwy	1,289
Lulaton	U. S. G. S.	82
Lumber City	U. S. G. S.	146
Lumpkin, Station	Aneroid	515
Lyerly	U. S. G. S.	644
Lynn	U. S. G. S.	173
Lyons	S. A. L.	254
McBean Station	U. S. G. S.	138
McCallie Gap	U. S. G. S.	2,069
McCalls	C. of G. Rwy	1,061
McClenny, Fla.	S. A. L.	125
McCormick	U. S. G. S.	535
McCrary	G. R. R.	342
McDaniels	W. & A. R. R.	656
McDonald	A. C. L.	177
McDonough	U. S. G. S.	861
McGregor	Aneroid	328
McGriff	U. S. G. S.	259
McIntosh	A. C. L.	22
McIntyre	C. of G. Rwy	261
McIntyre	U. S. G. S.	270
McKinnon	U. S. G. S.	65
McPherson	S. Rwy	1,011
McPherson Barracks	U. S. C. & G. S.	1,078
McRae	U. S. G. S.	230
Mableton	U. S. G. S.	980
Macon	G. S. & F. Rwy	334
near Sou. Rwy	U. S. G. S.	311
Macon Junction	C. of G. Rwy	350
Madison	G. R. R.	667
Madras	A. & W. P. R. R.	983
Manassas	S. A. L.	217
Manchester	U. S. G. S.	800?
Manson	U. S. G. S.	60

TOWN	AUTHORITY	ELEVATION
Marietta	W. & A. R. R.	1,118
Marlow	U. S. G. S.	72
Marshallville	C. of Ga.	500
Martin	S. Rwy	919
Mattox	U. S. G. S.	70
Matthews	U. S. G. S.	394
Maxey	G. R. R.	728
Mayday	G. S. & F. Rwy	140
Mayfield	Ga. R. R.	417.5
Maysville	S. Rwy	1,012
Meigs	A. C. L.	341
Meinhard	S. A. L.	19
Meldrim	C. of G. Rwy	28
Melrose	G. S. & F. Rwy	154
Mendes	U. S. G. S.	179
Mesena	G. R. R.	545
Metcalf	A. C. L.	170
Middleton	S. A. L.	503
Midville	C. of G. Rwy	186
Milan	Anerold	310
Milledgeville	U. S. G. S.	326
Milledgeville	G. S. R. R.	276
Millen	U. S. G. S.	160
Miller	S. Rwy	717
Millhaven	U. S. G. S.	110
Millwood	A. C. L.	160
Milner	C. of G. Rwy	844
Mina	S. A. L.	1,022
Mincie	U. S. G. S.	1,911
Mineola	G. S. & F. Rwy	220
Mineral Bluff	U. S. G. S.	1,571
Misler	U. S. G. S.	293
Modoc	U. S. G. S.	406
Moniac	U. S. G. S.	117
Monks	A. & W. P. R. R.	1,023
Monroe	U. S. G. S.	910
Monteith	A. C. L.	16
Montezuma	C. of G.	300
Montezuma	A. B. & A. Rwy	184
Montezuma	Aneroid	265
Monticello	Weather Bureau	800
Montreal	S. A. L.	992
Montrose	M. D. & S.	391?
Moores Mill	S. Rwy	867
Moreland	A. & W. P. R. R.	937
Morgan	Weather Bureau	337
Morganton	U. S. G. S.	1,967
Morris	C. of G. Rwy	242
Morrow	C. of G. Rwy	931
Mossy Creek	U. S. G. S.	1,402
Mount Airy	S. Rwy	1,561
Mount Pleasant	U. S. G. S.	56
Mount Vernon	Highway Eng.	230
Moultrie	Aneroid	340
Mouse Creek	U. S. G. S.	977
Munnerlyn	U. S. G. S.	268
Murphy Junction	L. & N. Rwy	1,655
Muscogee	U. S. G. S.	245
Myers	S. A. L.	45

TOWN	AUTHORITY	ELEVATION
Nacoochee	U. S. G. S.	1,440
Nahunta	U. S. G. S.	66
Nances	C. of G. Rwy	537
Nashville	Aneroid	265
Naylor	A. C. L.	192
Needmore	U. S. G. S.	67
Nesbitt	U. S. G. S.	145
Newell	U. S. G. S.	77
Newington	U. S. G. S.	143
Newnan	A. & W. P. R. R.	957
Newton	Aneroid	95
Nicholls	A. B. & A. Rwy	193
Nicholson	S. Rwy	904
Nickajack	U. S. G. S.	850
Norcross	S. Rwy	1,072
Norman Park	Aneroid	380
North Athens	U. S. G. S.	973
North Rome	U. S. G. S.	630
Norton	U. S. G. S.	816
Norwood	G. R. R.	588
Oakdale	U. S. G. S.	809
Oakey, Mount	U. S. G. S.	3,209
Oak Hurst	L. & N. Rwy	1,154
Ocilla	Aneroid	327
Ochillee	U. S. G. S.	273
Ochlocknee	A. C. L.	263
Ochwalkee	U. S. A. Eng.	114.4
Oconee, Baldwin Co.	G. R. R.	433
Oconee, Washington Co.	C. of Ga. Rwy	223
Oculus	U. S. G. S.	1,659
Odenville	A. B. & A. Rwy	728
Odum	U. S. G. S.	155
Offerman	A. C. L.	106
Ogeechee	U. S. G. S.	180
Oglesby	S. A. L.	464
Oglethorpe	C. of G. Rwy	299
Ohatahee	A. B. & A. Rwy	508
Ohoopee	S. A. L.	187
Ocmulgee	S. Rwy	124
Old Nell Knob, Towns Co.	U. S. G. S.	3,222
Old Sardis	U. S. G. S.	257
Oliver	U. S. G. S.	108
Olney	U. S. G. S.	63
Omaha	Rough est.	240
Oostanaula	U. S. G. S.	632
Orange Bluff	U. S. G. S.	10
Orchard Hill	C. of G. Rwy	863
Oredell	S. Rwy	788
Osierfield	Aneroid	350
Ousley	A. C. L.	148
Palestine	A. B. & A. Rwy	880
Palmetto	A. & W. P. R. R.	1,023
Paramore Hill	C. of G. Rwy	235
Paris, Mount, Fannin Co.	U. S. G. S.	2,318
Parke Knob, Union Co.	U. S. G. S.	3,680
Parkwood	U. S. G. S.	25
Parksville	U. S. G. S.	352
Parrott	S. A. L.	482
Parsons	A. B. & A. Rwy	641

TOWN	AUTHORITY	ELEVATION
Paschal	C. of G.	669
Patterson	A. C. L.	104
Paynes Mountain	U. S. G. S.	3,242
Peach	U. S. C. & G. S.	1,068
Pearson	U. S. G. S.	205
Pelham	U. S. G. S.	355
Pembroke	U. S. G. S.	94
Pendarvis	U. S. G. S.	85
Pennick	U. S. G. S.	18
Perdues	C. of G. Rwy	1,044
Perkins	U. S. G. S.	233
Perry	Aneroid	355
Peterson	U. S. G. S.	73
Peyton	U. S. G. S.	853
Phelps	U. S. G. S.	712
Pikes Peak	M. D. & S.	534
Pine Grove	U. S. G. S.	229
Pinehurst	G. S. & F. Rwy	390
Pine Log Mountain	U. S. C. & G. S.	2,340
Pine Log	U. S. C. & G. S.	800?
Pine Mountain, White County	U. S. G. S.	2,342
Pine Mountain	U. S. C. & G. S.	1,052
Pineora	U. S. G. S.	75
Pine View	Aneroid	288
Pink, Mount, White County	U. S. G. S.	2,709
Pinnacle, Mount, White Co.	U. S. G. S.	3,130
Pinson	U. S. G. S.	653
Piscola	Weather Bureau	190
Plains	Aneroid	490
Plainville	U. S. G. S.	677
Plum Branch	U. S. G. S.	462
Point Peter	Weather Bureau	1,000
Pooler	C. of G. Rwy	23
Popes	U. S. G. S.	349
Portal	U. S. G. S.	294
Porter Springs	U. S. G. S.	1,781
Potato Patch, Mount	U. S. G. S.	3,600
Poulan	A. C. L.	345
Powder	S. A. L.	970
Powder Springs	U. S. G. S.	912
Powersville	C. of G. Rwy	385
Prentiss	S. Rwy	207
Presley	U. S. G. S.	2,029
Pretoria	U. S. G. S.	220
Prior	S. Rwy	830
Pulaski	U. S. G. S.	220
Quitman	A. C. L.	173
Rabun Bald	U. S. C. & G. S.	4,717
Race Pond	A. C. L.	148
Ragland	A. & B. A. L.	493
Rahns	U. S. G. S.	73
Ramburst	U. S. G. S.	763
Randall	S. A. L.	704
Ravenel	U. S. G. S.	739
Raybon	U. S. G. S.	49
Rebecca	A. B. & A. Rwy	260
Recovery	A. C. L.	189
Red Clay	U. S. G. S.	823
Red Oak	A. & W. P. R. R.	1,046

TOWN	AUTHORITY	ELEVATION
Reeves	U. S. G. S.	636
Register	U. S. G. S.	171
Reid	U. S. G. S.	272
Reidsville	Estimate	200
Renfroes	S. A. L.	601
Resaca	W. & A. R. R.	644
Reynolds	C. of G.	433
Riceboro	Rough est.	15
Rich Hill	Aneroid	707
Rich, Mount	U. S. G. S.	4,081
Richland	S. A. L.	600
Richwood	G. S. & F. Rwy	358
Ridge	U. S. C. & G. S.	1,070
Rincon	S. A. L.	75
Ringgold	W. & A. R. R.	784
Rising Fawn	A. G. S. R. R.	787
River Junction	L. & N.	84
River, Mount, Rabun County	U. S. G. S.	3,872
Roberta	Aneroid	487
Roberts Station	Ga. R. R.	557
Rochelle	Aneroid	369
Rockmart	U. S. G. S.	764
Rock Mountain	U. S. G. S.	2,629
Rocky Comfort	G. R. R.	467
Rocky Face	W. & A. R. R.	771
Rocky Ford	U. S. G. S.	124
Rocky Knob, Towns County	U. S. G. S.	4,164
Rocky Mountain, Gilmer Co.	U. S. G. S.	3,541
Rocky Mountain, Towns Co.	U. S. G. S.	3,713
Rocky Mountain, Union & Towns	U. S. G. S.	4,586
Rocky Mountain, White County	U. S. G. S.	3,539
Rocky Top, Union County	U. S. G. S.	3,060
Roderick	U. S. G. S.	79
Rogers, Burke County	C. of G.	159
Rogers, Bartow County	W. & A. R. R.	726
Rome	U. S. G. S.	610
Roopville	U. S. G. S.	1,254
Roseland	S. Rwy	1,024
Round Knob	U. S. G. S.	3,492
Round, Mount	U. S. G. S.	3,360
Royston	S. Rwy	911
Ruby	W. & A. R. R.	873
Rutledge	G. R. R.	711
Saffold	A. C. L.	105
Saint Charles	A. & W. P. R. R.	912
St. Clair	U. S. G. S.	387
St. George	U. S. G. S.	78
St. Marys	U. S. G. S.	15
Sal, Mount, White County	U. S. G. S.	2,356
Sales City	Aneroid	397
Sandersville	Aneroid	445
Sanford	U. S. G. S.	828
Sapp Still	U. S. G. S.	18
Sardis	U. S. G. S.	239
Sardis	S. Rwy	409
Satilla	A. C. L.	96
Savannah	A. C. L.	21
Sawdust	G. R. R.	522
Sawnee	U. S. C. & G. S.	1,967

TOWN	AUTHORITY	ELEVATION
Scarboro	C. of G. Rwy	147
Schlatterville	A. C. L.	133
School House Summit	G. R. R.	537
Scotland	U. S. G. S.	142
Screamer Mountain	U. S. G. S.	2,925
Screven	A. C. L.	124
Seayos	C. of G. Rwy	360
Sebastopol	C. of G. Rwy	225
Seney	U. S. G. S.	829
Shannon	U. S. G. S.	684
Sharptop, Mount, Union Co.	U. S. G. S.	2,803
Shawnee	U. S. G. S.	124
Sheba	U. S. G. S.	580
Shell Bluff (P. O.)	U. S. G. S.	301
Shellman	C. of Ga.	379
Sheriff Knob, Union Co.	U. S. G. S.	3,400
Shilo	U. S. G. S.	906
Sibley	G. S. & F. Rwy	440
Silver Creek	U. S. G. S.	680
Sisters Ferry	U. S. A. Eng.	20.03
Sitting Bull Mountain	U. S. C. & G. S.	5,046
Six Mile	S. Rwy	672
Skienah Gap	U. S. G. S.	2,374
Skitt Mountain	U. S. C. & G. S.	2,076
Slover	U. S. G. S.	92
Smithville	C. of G.	332
Smyrna	W. & A. R. R.	1,053
Snake Mountain, Rabun Co.	U. S. G. S.	3,365
Social Circle	G. R. R.	861
Sofkee	G. S. & F. Rwy	370
Soperton	Aneroid	308
Soque	U. S. G. S.	1,686
South Atlanta	U. S. G. S.	1,016
Southover Junction	A. C. L.	20
South Switch	U. S. G. S.	1,063
Spaniard Knob, Towns Co.	U. S. G. S.	3,860
Sparks	G. S. & G. Rwy	241
Sparta	Ga. R. R.	557
Springfield	U. S. G. S.	80
Springer, Mount	U. S. G. S.	3,820
Spring Place	U. S. G. S.	730
Star Buck Field	U. S. G. S.	812
Star Point	U. S. G. S.	1,074
Statenville	A. C. L.	152
Statesboro	U. S. G. S.	218–250
Statham	S. A. L.	864
Stapleton	U. S. G. S.	440
Sterling	U. S. G. S.	21
Stevens Gap	U. S. G. S.	1,996
Stillmore	Aneroid	275
Stillwell	U. S. G. S.	96
Stillson	U. S. G. S.	105
Stockbridge	U. S. G. S.	810
Stockton	A. C. L.	187
Stone Mountain	G. R. R.	1,026
Stone Mountain	U. S. C. & G. S.	1,686
Stone Village	U. S. C. & G. S.	1,037
Strawberry Top, Union Co.	U. S. G. S.	3,744
Sugar Valley	U. S. G. S.	646

TOWN	AUTHORITY	ELEVATION
Sulphur Springs	U. S. G. S.	300
Sulphur Springs	A. G. S. R. R.	897
Summerfield	C. of G. Rwy	481
Summerville	U. S. G. S.	780
Sumner	A. C. L.	373
Sunhill	C. of G.	362
Sunnyside	C. of G.	929
Surrency	U. S. G. S.	187
Suwanee	S. Rwy	1,027
Suwanee Mountain	U. S. G. S.	1,967
Swainsboro	Aneroid	318
Sweat Mountain	U. S. C. & G. S.	1,694
Swift Creek	M. D. & S.	324
Sycamore	G. S. & F. Rwy	415
Sylvania	U. S. G. S.	238
Sylvester	A. C. L.	370
Talbotton	U. S. G. S.	726
Talking Rock	L. & N. Rwy	1,084
Tallapoosa	S. Rwy	1,158
Tallulah Falls	U. S. G. S.	1,629
Tallulah Mountain, N. W. summit	U. S. C. & G. S.	3,172
Tallulah Mountain, S. E. summit	U. S. C. & G. S.	2,849
Tally Mountain	U. S. G. S.	1,474
Talona	L. & N. Rwy	1,208
Talona, Mount, Gilmer Co.	U. S. G. S.	2,115
Tarboro	U. S. G. S.	12
Tarrytown	Aneroid	310
Tasso	U. S. G. S.	800
Temple	S. Rwy	1,177
Tennga	U. S. G. S.	837
Tennille	C. of G. Rwy	469
Tesratee	U. S. G. S.	1,526
Tesnatee Gap, Union Co.	U. S. G. S.	3,138
Thalman	U. S. G. S.	20
Thelma	G. S. & F.	158
Thomas	C. of G.	285
Thomas	S. A. L.	1,040
Thomasville	A. C. L.	250
Thomson	G. R. R.	503
Three Sisters, Lumpkin Co.	U. S. G. S.	2,185
Thickanetley Bald, Gilmer Co.	U. S. G. S.	4,054
Tifton	A. C. L.	370
Tifton, Mount, Fannin Co.	U. S. G. S.	3,201
Tignall	U. S. G. S.	644
Tilton	W. & A. R. R.	654
Tivola	G. S. & F. Rwy	300
Toccoa	S. Rwy	1,045
Toomsboro	U. S. G. S.	236
Toonigh	L. & N. Rwy	1,042
Towns	U. S. G. S.	128
Tray Mountain	U. S. G. S.	4,389
Tree	U. S. C. & G. S.	1,045
Trenton	A. G. S. R. R.	729
Tripp	S. A. L.	1,100
Troy	U. S. G. S.	520
Trudie	U. S. G. S.	56
Tucker	S. A. L.	1,087
Tulip	U. S. G. S.	694
Tunis	U. S. G. S.	783

TOWN	AUTHORITY	ELEVATION
Tunnel Hill	W. & A. R. R.	840
Turkey Mountain	U. S. G. S.	1,192
Turniptown Mountain, Gilmer Co.	U. S. G. S.	3,614
Tusculum	U. S. G. S.	122
Tyty	A. C. L.	332
Unadilla	G. S. & F. Rwy.	412
Undine	U. S. G. S.	155
Unicoi Gap, Towns County	U. S. G. S.	2,963
Union Point	G. R. R.	644
Univester	L. & N. Rwy.	1,090
Upatoi	U. S. G. S.	418
Uptonville	A. C. L.	83
Uvalda	Aneroid	185
Valambrosa	M. D. & S.	258?
Valdosta	A. C. L.	215
Valona	Weather Bureau	10
Vanns Valley	S. Rwy.	628
Varnell	U. S. G. S.	808
Verbena	C. of G. Rwy.	1,044
Vernon	U. S. G. S.	661
Vidalia	Aneroid	300
Vidette	U. S. G. S.	350
Vienna	G. S. & F. Rwy.	350
Villa Rica	S. Rwy.	1,156
Vining	W. & A. R. R.	931
Virgin	U. S. G. S.	329
Waco	S. Rwy.	1,357
Wadley	C. of G. Rwy.	234
Wainwright	U. S. G. S.	85
Walden	C. of G.	390
Walker, Mount, White Co.	U. S. G. S.	2,641
Walnut, Mount, Gilmer Co.	U. S. G. S.	2,628
Walthourville	A. C. L.	95
Ward	C. of G. Rwy.	392
Waresboro	A. C. L.	150
Waring	U. S. G. S.	795
Warrenton	G. R. R.	500
Warthen	Aneroid	490
Washington	U. S. G. S.	618
Watson, Mount, Fannin County	U. S. G. S.	2,769
Waverly	S. A. L.	17
Waverly Hall	U. S. G. S.	729
Waycross	A. C. L.	138
Waynesboro	U. S. G. S.	261
Waynesville	U. S. G. S.	50
Ways	A. C. L.	18
Wellston	G. S. & F.	315
Wenona	G. S. & F. Rwy.	348
West Bowersville	S. Rwy.	918
Westbrook	L. & N. Rwy.	1,500
West Green	Aneroid	255
Westlake	U. S. G. S.	235
West Point	W. Rwy. of A.	576
Weston	S. A. L.	528
Westover	U. S. G. S.	142
Wheaton	U. S. G. S.	201
Whigham	A. C. L.	265
White Oak	U. S. G. S.	15
White Path	L. & N. Rwy.	1,444

TOWN	AUTHORITY	ELEVATION
Whitesburg	Weather Bureau	1,050
White Oak	U. S. G. S.	15
White Path	L. & N. Rwy	1,444
Whitesburg	Weather Bureau	1,050
Wilcox	S. Rwy	116
Willacoochee	A. C. L.	247
Willetts	U. S. G. S.	250
Willie	U. S. G. S.	87
Williams	S. Rwy	544
Willingham	A. C. L.	319
Willis	M. D. & S.	394
Wilscot Mountain, Fannin Co.	U. S. G. S.	3,151
Wilson, Mount, Union Co.	U. S. G. S.	3,047
Winchester	C. of G.	463
Winder	S. A. L.	941
Winston	S. Rwy	1,135
Winters	G. R. R.	786
Wolfpen Ridge, Towns County	U. S. G. S.	4,251
Woodbine	U. S. G. S.	14
Woodlawn	S. A. L.	661
Woodstock	L. & N. Rwy	992
Woodville	G. R. R.	693
Worth	G. S. & F.	415
Wray	A. B. & A. Rwy	279
Wrens	U. S. G. S.	423
Wrightsville	Aneroid	335
Yancey	S. Rwy	706
Yellow Mountain, Union County	U. S. G. S.	3,173
Yonah, Mount, White County	U. S. G. S.	3,173
Young Harris	U. S. G. S.	1,928
Zenith	Aneroid	567
Zuni	A. B. & A. Rwy	656

The abbreviations used are,

A. & W. P.-Atlanta and West Point Railroad.
A. B. & A.-Atlanta, Birmingham & Atlantic Railroad.
A. C. L.-Atlantic Coast Line Railroad.
C. of Ga.-Central of Georgia Railroad.
G. R. R.-Georgia Railroad.
G. F. & A.-Georgia, Florida & Alabama Railroad.
G. S. & F.-Georgia Southern & Florida Railroad.
L. & N.-Louisville & Nashville Railroad.
M. D. & S.-Macon, Dublin & Savannah Railroad.
S. A. L.-Seaboard Air Line Railroad.
S. & S.-Savannah & Southern Railroad.
S. Rwy.-Southern Railway.
U. S. A. Eng.-United States Army Engineers.
U. S. G. S.-United States Geological Survey.
U. S. C. & G.-S.-United States Coast & Geodetic Survey.
W. & A.-Western and Atlantic Railroad.

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