

To the Committee on Graduate Study:

I submit herewith a thesis by Mr. George C. Martin Jr., "The Effect of Physiography on the Trade Routes of East Tennessee", and recommend that it be accepted for eighteen quarter hours credit in fulfillment of the requirements for the degree of Master of Arts.

33

George R. Hall
Major Professor

At the request of the Committee on Graduate Study, I have read this thesis, and recommend its acceptance.

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THE EFFECT OF PHYSIOGRAPHY
ON THE
TRADE ROUTES OF EAST TENNESSEE

A THESIS

Submitted to the Graduate Committee
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for
The Degree of Master of Arts

by

GEORGE C. MARTIN JR.



August 1932

P R E F A C E

The parallelism of the topographic forms of East Tennessee is classic in the world. The influence of topography on the trade routes of the region is evident from a map of roads or railroads. This paper is an attempt to show the adjustment of trade routes to physiographic forms in East Tennessee.

This study has been greatly facilitated by many individuals to whom I am indebted for many courtesies. Exceptional cooperation was rendered by: Dr. George M. Hall, Dr. Philip M. Hamer, Professor H. C. Amick, Mr. L. H. Rollins, Mr. J. G. Walls, and Mr. Berlen C. Moneymaker. Mr. W. O. Whittle was of great assistance in the location of Indian trails, and officials of the Southern and Louisville and Nashville Railroads extended many courtesies to the writer.

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GEOGRAPHY OF EAST TENNESSEE

Location and Size

East Tennessee, as treated in this report, is coextensive with the political division of the State known as East Tennessee. It includes that portion of the state lying between the Tennessee-North Carolina line and the western boundaries of Scott, Morgan, Roane, Rhea, Bledsoe, Sequatchie, and Marion Counties. The southern boundary coincides approximately with the parallel of 35 degrees North latitude, and the northern limit is a broken line lying between the parallels of 36 degrees 29 minutes and 36 degrees 41 minutes North latitude. This division of the State is about 200 miles long from the north-east to south-west, with a width of approximately seventy miles along the northern boundary of the State, narrowing to a width of approximately forty miles along the Tennessee-Georgia line. It has an area of approximately 12,000 square miles which exceeds one-fourth of the surface area of the State.

East Tennessee lies entirely within the Southern Appalachians. The Southern Appalachians are made up of six major physiographic divisions each of which has a general north-east to south-west trend. They are the Piedmont Plateau, Appalachian Mountains, Appalachian Valley, Appalachian Plateau, Highland Rim, and the Nashville and Blue Grass Basins. The divisions are remarkably uniform throughout their entire length, due to the fact that geologic forces have tended to produce similar results in sedimentation, geologic structure, and topography.

1. Bowman, Isaiah, Forest Physiography, pp. 585-588.

2. Knoxville Folio No. 16, U.S. Geological Survey, p. 1.

East Tennessee consists of segments of the western part of the Appalachian Mountains, the Appalachian Valley, and the eastern part of the Appalachian Plateau, known locally as the Cumberland Plateau. These three physiographic divisions of East Tennessee exhibit distinctive types of topography dependent upon the character and attitude of the underlying strata. (The divisions are shown in Plate 1.)

The Unaka Chain

The Unaka Chain is the local name for the Appalachian Mountains of East Tennessee. It is the eastern physiographic division of East Tennessee and forms the eastern or southeastern boundary of the Great Valley of East Tennessee. This chain includes the Great Smoky Mountains and is the most massive of the ranges of the Appalachian Mountain System. Its crest has a general elevation of 5,000 feet and is, for the most part, the line dividing Tennessee and North Carolina. The chain is not a single great ridge but rather a long belt of parallel ridges, which vary at different places, counted across the chain, from two to four in number. The main axis of the range is continuous excepting where it is intersected by the deep and narrow gorges of the tributaries of the Holston and Tennessee Rivers that flow out of North Carolina and the northeastern corner of Georgia. These divide it into sections which abut end to end. That part of the Unaka Chain lying within Tennessee is a belt of parallel ridges about 200 miles long with an average width of thirteen miles. Its width varies, however, from two to twenty miles. In general, the Tennessee portion is divided, longitudinally into two ranges, one



Plate I. The Southern Appalachian Region.

the high main axis and its great spurs, the other a subordinate chain of outliers mostly detached from and lying along the base of the former. In the north-eastern corner of the State, there are three leading ranges separated by wide and fertile valleys. These ridges converge towards the north-east, the two most westerly ones blending into a common ridge as they enter Virginia where they unite with the third to form a single great ridge.³

The Great Valley of East Tennessee

The Great Valley of East Tennessee is that portion of the state lying between the Cumberland Plateau on the west or north-west and the Unaka Chain on the east or south-east. It is about 200 miles long with a width of about fifty miles in the north, narrowing to approximately 34 miles at the Tennessee-Georgia line. It has an area of approximately 9,200 square miles.⁴ The natural northern boundary of the Valley of East Tennessee lies within the state of Virginia, on the Mount Airy divide between the drainage basins of the New and Holston Rivers. The geographical southern boundary lies within the state of Georgia on the watershed between Chickamauga Creek and the Coosa River.

The Tennessee Valley is a segment of that great, long, and complex trough which extends from southeastern New York to the central part of Alabama. The great trough is popularly spoken of as one valley, but it has different local names and is drained by a number of streams. This great valley has

3. Safford, James M., The Geology of Tennessee pp. 21-24.

4. Case, Earl C., The Valley of East Tennessee, p. 9.

a remarkable continuity which has made it a great highway. The divides between the various basins are usually low and indistinct and do not constitute barriers of a serious nature.

The Great Valley of East Tennessee has the Appalachian characteristics well developed; it is closely furrowed with parallel valleys and ridges all trending north-east and south-west. The floor of the valley is uniformly in slopes. The ridges differ more or less in length, height, width, steepness of slope, and sharpness of outline. At the same time, each one is remarkable for the uniformity of character it preserves from one end to another, a distance of a hundred miles or more in some cases. The surface from north-west to south-east is remarkably rolling. On the other hand the profile from north-east to south-west is characterized by gentle gradients and smooth slope. This is illustrated by Plate 2.

Several ridges in the northeastern part of the valley and one in the southern part are called mountains. Most of these prominent ridges terminate abruptly within the boundaries of Tennessee. Those in the north are arranged in three groups, one of which belongs exclusively to Tennessee. The Powell's Mountain group is a series of three great parallel ridges which enter Tennessee from the north-east and terminate in the northeastern part of Claiborne County. The Clinch Mountain ridge enters from Virginia and runs in an almost straight line to within sight of Knoxville where it terminates in a bold end. Clinch Mountain has a sharp crest and well-defined outlines and is the most prominent of all the ridges in the valley. Close along the southeastern base there is, generally, a low sharp ridge, and in Hawkins County there are



GENERALIZED NORTHWEST SOUTHEAST CROSS SECTION OF EAST TENNESSEE

HORIZONTAL SCALE 1-500,000
 VERTICAL SCALE 1-125,000

Plate II.

several heavy ridges. House Mountain in Knox County is an isolated roof-like ridge and might be included in this group. The Bays Mountain group lies wholly within the State of Tennessee. It is a group of six sharp, straight ridges, which are separated by narrow trough-like valleys. The group extends from near Kingsport to a point several miles below Bull's Gap, a distance of about forty miles. Towards either end, the ridges drop away one after another and the group terminates in single ridges. White Oak Mountain is the outstanding ridge in the southern part of the valley. It appears near Georgetown and runs southwestward into Georgia.⁵

There are several different types of the smaller ridges in the valley. Many of them are rounded or depressed along the summits or crests. These are generally cherty limestone ridges of great length. Most of them have a comparatively unbroken outline, others are more or less cut into a succession of dome-like knobs. A second type includes ridges which are steep and sharp crested. These owe their characteristic forms to the sandstone or shaly layers which they contain. They frequently alternate with those of the first class, and like them extend a great number of miles. Sometimes the crests are serrated, affording lines of pointed peaks. Another class includes a number of long ranges of "Red Knobs" or "Red Hills" traversing the southeastern part of the valley. The knobs are separated from each other by deep gaps. They have, ordinarily, a conical shape, and their peaks are from 200 to more than 400 feet above the general level of the valley. These curious hills mark out straight or gently curving ranges remarkable for their length

5. Safford, James M., The Geology of Tennessee, pp. 42-44.

and their uniform appearance throughout. The shale belts in the east and northeast part of the valley are characterized by broken ridges and knobs which make up a fourth class of valley topography. The knobs are crowded together without any apparent order and vary in height from 100 to 500 feet above the valley floor.⁶

For the purpose of illustrating the surface features of the valley, some of the prominent valley ridges will be noted in connection with the different sections in which they occur. The region west and north of Knoxville is distinguished for its numerous parallel ridges, some of which are remarkable for their size, directness and length. These have a cherty limestone basis. Alternating with them are many sharp crested sandstone ridges.

The section of the valley northeast of the French Broad and east of Bays Mountain is furrowed with valleys and ridges with the characteristic Appalachian trend. Sharp, narrow, shale ridges are a peculiarity of this region. They seldom exceed 8 miles in length. Another feature is the occurrence, especially in Sullivan County, of belts of shale knobs. These knobs are crowded together without any apparent arrangement.

South and east of Knoxville and north of the Little Tennessee River is a section in which the ridges are better defined, but not so well defined as in the adjacent section to the northwest. The "Red Knobs" constitute one of the most prominent features of the region. They appear in Jefferson County and in the northern part of Blount County and extend southwestward along the margins of the two shale belts traversing the State.

6. Safford, James M., The Geology of Tennessee, pp. 46-48.

These shale belts are often knobby.

The southern part of the valley is, in general, very uniformly fluted with valleys and ridges. This section contains numerous long ridges, both sharp crested and rounded, many of which are continuations of those traversing the section north and west of Knoxville. North of the city of Chattanooga and west of the Tennessee River is a strip from four to six miles wide which is broken and hilly. The knobs are dome-like and are covered with flinty gravel. South of Cleveland and east of the Southern Railroad, there is much uniformity of direction and arrangement of subordinate parts. Here the ridges are principally rounded with a few conspicuous lines of red hills.⁷

The ridges mark out the valleys. In the western half of the Great Valley, the valleys have the greatest longitudinal length and the greatest regularity in their arrangement. There are several valleys which run continuously through the State from north-east to south-west and extend each way beyond the limits of the State. The valleys are short and broken in the northeastern part of the valley in the region characterized by the knobby hills. South-west of this section and especially south-west of the Hiwassee River, there are again longitudinal valleys succeeding each other laterally with considerable regularity. The valleys in general vary in width from a few hundred yards to several miles.

There are outlying valleys or coves interlocked with the ranges of the Unaka chain and the Cumberland Plateau. An outstanding example is Johnson County Cove in the north-

7. Case, Earl C., The Valley of East Tennessee, pp. 2-3

eastern part of the State. It is valley land, 2,000 feet above sea-level entirely enclosed, except for the very narrow, rocky gaps cut by stream erosion. There are two great coves confined within the limits of the table-land.⁸ Sequatchie valley is a great cove sunk lengthwise in the body of the Plateau dividing it into two unequal parts. It is bordered on both sides by the high, steep, inner escarpments of these portions. These are from three to five miles apart, and the valley is about sixty miles long in Tennessee. The second cove referred to is that of Elk Fork Valley. It extends from Elk Gap north-eastward into Kentucky. Stream erosion along fault zones where calcareous rocks were exposed resulted in the formation of this cove.

The Cumberland Plateau

The eastern part of the Cumberland Plateau is the westernmost of the three physiographic divisions of East Tennessee. It is a part of a long belt of high land extending from the southern part of New York to central Alabama. The surface of the plateau is comparatively flat, but low ridges with their intervening valleys break the monotony. The escarpment bordering the Great Valley breaks off suddenly in sandstone cliffs which are from twenty to 200 feet high. The escarpment is approximately 1,000 feet above the floor of the Great Valley. It crosses Tennessee obliquely from north-east to south-west, sharply demarcating the western limits of the Tennessee Valley. Along the Tennessee-Kentucky boundary, the Plateau is about seventy-one miles wide. It becomes narrower southward, having

8. Safford, James M., Geology of Tennessee, p. 49.

a width of fifty miles along the southern border of the State including Raccoon Mountain and Sequatchie Valley.

The table-land increases in altitude from approximately 1,500 feet in northern Alabama to 2,000 feet in central Tennessee, and 3,500 feet in southeastern Kentucky. The surface of the Plateau slopes gently westward from its greatest altitude near its eastern escarpment, although it is separated from the Highland Rim by a bold ramifying escarpment. Small isolated hills rise from 100 to 500 feet above the general level of the plateau, while some of the more vigorous streams have cut the lower part of their channels from fifty to 100 feet below the general level.

The arm of the table-land that lies along the southeastern side of Sequatchie Valley is relatively uniform. It varies from six to eight miles in width and extends from east of the Crab Orchard Mountains southwestward into Georgia and Alabama. However, near the Georgia line, its continuity is broken by two gorges. The Tennessee River completely cuts through it, forming a deep, narrow gorge. Partly upon the stateline, it is cut by Running Creek, not so deeply as the Tennessee River but forming a low gap. North of the Tennessee River Canyon, this arm of the Plateau is known as Walden Ridge, and south of this Canyon as Raccoon Mountain. Walden Ridge has most of the characteristics of the plateau west of Sequatchie Valley. It is somewhat higher, having an altitude between 1,900 and 2,000 feet. Its streams rise near the edge of Sequatchie Valley and flow southwestward in shallow channels, until near the eastern escarpment, where they plunge into

narrow gorges.

Drainage of East Tennessee

The drainage of East Tennessee is mostly westward to the Ohio River thence to the Gulf of Mexico by way of the Mississippi River. It is drained almost entirely by the Tennessee River System, which is made up of the following rivers and their tributaries: Tennessee, Holston, Watauga, Nolichucky, French Broad, Little, Little Tennessee, Hiwassee, Sequatchie, Clinch, and Powell. In the northwest corner of East Tennessee, a portion of the Cumberland Plateau is drained by tributaries of the Cumberland River. Small parts of Bradley and Polk Counties in the southeastern part of the State are drained southward by way of the Oostanala, Coosa, and Alabama Rivers to the Gulf of Mexico.

The Tennessee River is formed by the junction of the Holston and French Broad Rivers four and one-half miles east of Knoxville. The Holston is the continuation of the Tennessee up the valley, and the French Broad is the tributary stream. The Tennessee meanders irregularly throughout much of its course, especially in its upper stretches. On the convex sides of the curves it is often bordered by bluffs, while there are usually fertile flood plains on the concave sides of the meanders.¹⁰ The river maintains a general southwestward direction to below Chattanooga, where it leaves the Great Valley of East Tennessee and, sweeping past the foot of Lookout Mountain in picturesque Moccasin Bend, turns abruptly westward to enter the winding gorge carved across Walden Ridge. Emerging in Sequatchie Val-

10. Glenn, L.C., Professional Paper No. 72, U.S. Geological Survey, p. 79.

ley it turns again southwestward into Alabama.

The Holston River has its headwaters a few miles south of Tazewell, Virginia. From its source, it flows southwestward to its union with the French Broad River. The Holston River, like the Tennessee, meanders throughout most of its course, but maintains its direction with more exactness than the Tennessee. The basin of the Holston River has an extreme length of about 170 miles. The lower 140 miles are narrow, but the upper basin has an average width of 50 miles. The river and its tributaries flow over rock bottom or bed rock with a thin covering of sand and gravel. The South Fork of the Holston River rises about ten miles southeast of W. theville, Virginia and flows westward to the vicinity of Bluff City where it turns westward and joins the North Fork below Kingsport.

The Watauga River is one of the more important tributaries of the Holston. It rises in the Blue Ridge Mountains near Boone, N. C., and flows northwestward across the general trend of Appalachian topography. It enters the South Fork of the Holston about ten miles east of Bluff City, Tennessee. Its basin is compact in shape and may be divided into two parts, a larger eastern part lying in the North Carolina Mountains, and a smaller western one in the Valley of East Tennessee.

The Nolichucky River has its headwaters on the slopes of Mount Mitchell in western North Carolina. It winds northwestward to near the Tennessee State line and then turns in a more westward direction across the ridges of East Tennessee to its union with the French Broad about ten miles south of Morristown. The Nolichucky River is formed by the confluence of the

Toe and Cane Rivers eight miles east of the Tennessee line. Its basin is about 75 miles long, and has an average width of about 25 miles. Its basin, like that of the Watauga, may be divided into two parts, an upper part lying in the North Carolina mountains and a lower part in the Great Valley of East Tennessee.

The French Broad River rises in northwestern South Carolina and western North Carolina on the western slope of the Blue Ridge Mountains. It flows northwestward across the Unaka mountains and half way across the Tennessee Valley to its junction with the Holston River. Its basin lies between that of the Nolichucky on the northeast and the Little and Little Tennessee basins on the south and southeast. It also is divided transversely by the Unaka Chain, locally called the Great Smoky Mountains. The upper part is about 60 miles long and approximately 45 miles wide and lies on the Asheville Plateau. The Tennessee portion is about 30 miles long and somewhat narrower than the Carolina portion. An important tributary is the Big Pigeon. It rises about ten miles south of Waynesville, N.C., and flows in a general northwestward direction to enter the French Broad north of Newport, Tennessee.

The Little River heads upon the western slope of the Great Smokies and flows northwestward to enter the Tennessee River 12 miles below Knoxville. Its basin lies between the basin of the French Broad and that of the Little Tennessee. It is divided into two parts by the Chilhowee mountains. The upper part is inclosed by the Great Smokies and their spurs; the lower part lies in the Tennessee Valley.

The Little Tennessee River rises in northeastern Geor-

gia and flows in a general northwestward direction to its junction with the Tennessee near Loudon, Tennessee. Its principal tributaries are the Cheoah, Tuckasegee, Nantahala, and Tellico Rivers. The first three are rivers of the North Carolina Mountains and are famous for their deep gorges and excellent water power possibilities. The Tellico is a Tennessee stream.

The Hiwassee River is the southernmost of the tributaries of any great size to enter the Tennessee River from the east. It has its headwaters in northeastern Georgia and southwestern North Carolina. Its principal tributary is the Ocoee. The Hiwassee and its tributaries are northwestward flowing streams. The basin varies in width from 35 to 50 miles in the 85 miles of its length. Like those of the other northwestward flowing streams, it consists of an upper mountainous portion and a lower valley portion.

The Sequatchie River drains Sequatchie Valley. It flows southwestward, meandering throughout its course, but never deviating greatly from its general direction. It enters the Tennessee near Jasper. Its drainage basin includes Grassy Cove northeast of Sequatchie Valley. The basin is about 80 miles long and has an average width of approximately four miles. Its major tributaries enter from the west.

The Clinch River rises a few miles north of Tazewell, Virginia, and flows southwestward to the Tennessee River, which it joins a few miles southeast of Kingston, Tennessee. This river, like the other southwestward flowing streams of East Tennessee, meanders irregularly. Its basin is slightly in excess of 160 miles in length and is relatively narrow. Powell River is the principal tributary of the Clinch. It rises a few

miles south of Big Stone Gap, Virginia, and flows southwestward roughly paralleling the Clinch. It meanders irregularly. The Powell joins the Clinch about ten miles east of Caryville,¹¹ Tennessee.

East Tennessee has a combination of dendritic and lattice patterns of drainage. The Sequatchie, Clinch, Powell, Holston, and Tennessee are tree-like. The French Broad, Little Tennessee, Little, and Hiwassee Rivers all enter the Tennessee Valley at approximately right angles. Yet each of these is arborescent in so far as its major tributaries are concerned. The majority of the smaller tributaries of the major rivers enter at approximately right angles, and most of the smaller streams are consequent on the initial slopes.

11. Glenn, L. C., Professional Paper No. 72, U. S. Geological Survey, p. 79.

GEOLOGY OF EAST TENNESSEE

Geologic History

Each of the three physiographic divisions of East Tennessee is developed on rocks of a distinctive structure and type. In the mountain district folds and faults are important features of the structure, but cleavage plains and other results of metamorphism are equally conspicuous. In the valley the rocks have been steeply tilted, bent into folds, and broken by faults. The structure of the plateau is that of a more or less dissected table-land. The strata are practically undisturbed and unaltered.

Lithology and rock structure control topographic forms to a large degree. In the Unaka Mountains the rocks are chiefly igneous and metamorphic with an extremely complex structure. The beds of greywacke, quartzite, slate, phyllite, and granite are but slightly soluble. The limestones and calcareous shales are in general easily eroded, and underlie most of the lowland in the Great Valley. Conglomerates, sandstones, and shales are more resistant to erosion and stand out as residuals of considerable height. Moreover, conglomerate and sandstone cap much of the Cumberland Plateau. In general, the strata of the valley and plateau grow thicker and less calcareous towards the southeast. In the valley they have been deformed and ordinarily dip to the southeast. The combined hardness and inclined position of the strata results in long symmetrical parallel ridges which are among the most notable physiographic features in the world.

1. Bowman, Isaiah, Forest Physiography, p. 587.

The physiographic divisions in general have a common geologic history. Each was affected, in a varying degree, by the mountain-building revolution which brought the Paleozoic Era to a close. The compression was greatest in the southeast and gradually died out northwestward. Therefore, the Unaka mountains exhibit the most complex folding and faulting; the Tennessee Valley is characterized by long, asymmetrical, parallel folds and less complex faults; while the Cumberland tableland has only a few folds and gentle flexures. The much higher and more crushed strata of the mountains were more easily eroded than the divisions to the northwest. However, when the deeper lying metamorphic and igneous rocks were exposed the mass became more resistant. Due to the large amount of calcareous material, the unmetamorphosed and less folded and faulted rocks of the valley have been removed by erosion faster than the metamorphosed rocks of the mountains and the unbroken rocks of the plateau. The horizontal attitude of the practically undeformed rocks of the plateau has made it possible for the resistant sandstone to protect the weaker underlying limestones from erosion.

The sedimentary records of each of the three divisions are similar. Four great cycles of sedimentation are recorded in the folded strata of this region. Two cycles are exhibited in the Plateau which are identical with the last two of the four cycles of the folded area to the southeast. The first of the great cycles of sedimentation begins with coarse conglomerates, sandstones, and shales deposited, in early Cambrian times, over most of the Appalachian Province. As the land

mass to the southeast was worn down and still further depressed the sediment became finer and more calcareous until the Knox Dolomite was laid down in Cambro-Ordovician time. There is very little trace of shore material. After this long period of quiet came a slight elevation producing coarser rocks. This uplift became pronounced until large areas of recently deposited sandstone were lifted above the sea and exposed to erosion. This uplift completed the first great cycle.

A depression inaugurated the second great cycle of sedimentation. The land was worn down to almost base-level, and the Mississippian black shale accumulated. After this a minor uplift of the land mass of Appalachia brought about the deposition of the Mississippian sandstones and shales.

The third cycle began with a depression during which the late Paleozoic limestone accumulated. A third uplift brought the limestone into shallow water, portions of it perhaps above the sea, and upon it were deposited the sandstones and shales of the coal measures of the Pennsylvanian and Permian Periods. Further uplift at the close of Paleozoic time ended the deposition of sediments in the Appalachian Province.²

The vertical movements of this district were regional and affected the Southern Appalachians as a unit. While there are great variations in structure and pronounced differences in elevation, most of the topographic features throughout the Appalachian Province are unified by peneplanations. The province has been a land surface since Paleozoic time. Uplifts were not continuous but intermittent, and were probably halted a number of times. The surface was stable during at least

2. Morristown Folio No. 27, U. S. Geological Survey, p. 1.

three long periods, allowing the formation of either extensive or local peneplains. A remarkable characteristic of each physiographic division of East Tennessee is the unity of origin and expression of a large number of topographic forms. Related forms are continuous over a large area, and indicate that conditions which produced them must have been continuous over the area.³

The Cretaceous peneplain, known locally as the Cumberland peneplain, is the most widely distributed topographic feature of this area. It is the highest and oldest plain of reference in the province, having an elevation of from 2,000 to 2,200 feet, and is exceptional for its extent and regularity. Later erosion has destroyed extensive areas of the old plain, but interstream areas waste slowly and have preserved the level of the Cretaceous peneplain. The Cumberland Plateau is probably the most extensive remnant. The land surface must have been stable for an exceedingly long time to allow the almost perfect reduction of such a great area. Only a few hills remained as residuals on the low plain.

An uplift in early Tertiary ended the Cretaceous cycle of erosion and started the early Tertiary cycle. The streams, which had almost reached base-level and meandered in their courses, were rejuvenated and began to erode the uplifted surface. The land remained stable long enough to permit the development of a rather extensive plain 600 to 700 feet below the Cretaceous peneplain. The accordant crests of many of the valley ridges and the Highland Rim in Middle Tennessee are remnants of this peneplain, which has an average elevation

3. Bowman, Isaiah, Forest Physiography, p. 591.

from 1,500 to 1,700 feet. The early Tertiary cycle of erosion was shorter than that of the Cretaceous period, and was terminated by a series of movements the algebraic sum of which was positive, or an uplift.

The late Tertiary cycle of erosion was inaugurated by the uplift which ended the early Tertiary cycle. The late Tertiary cycle, known also as the ~~Hoosa~~ Hoosa, progressed only on the softer rocks near the larger streams. Its development is local rather than extensive. The level of the late Tertiary peneplain is approximately 450 feet below the Highland Rim ⁴ peneplain, having an elevation of from 1, 100 to 1,200 feet.

There are, in addition to these three distinct levels, two less distinct. The even crest of the Cretaceous Peneplain is surmounted by residuals which form the peaks of the higher mountains, as Clingman's Dome, LeConte, Guyot, and other peaks of the Unakas as well as the monadnocks on the Cumberland Plateau. The second less distinct level is the lowest in the area, that of the young and narrow trenches and valleys with their associated terraces, below the late Tertiary peneplain. The highest level has been largely de-₅stroyed by erosion, while the youngest is poorly developed.

Drainage History

During the latter part of the Paleozoic era and up to the close of the Cretaceous period, the rivers that drained the Southern Appalachians flowed northwestward to the Mississippi embayment from the axis of the old land mass to the southeast. As the Cretaceous plain approached base-level,

4. White, C. H., Journal of Geology, vol. 12, pp. 34-39.

5. Bowman, Isaiah, Forest Physiography, p. 590.

the streams became sluggish and developed meanders, especially in their lower courses. There were three separate river systems that flowed northwestward in East Tennessee across the present Appalachian trend. The Fluvialis River was made up of the French Broad, the Nolichucky, and other tributaries more to the northeastern corner of the State. This former great river flowed northwestward leaving the State in the vicinity of Cumberland Gap. About midway between the southern and northern boundaries of East Tennessee in the vicinity of Emory Gap was the second great river called the Loudonesys. This system was made up of the tributaries in the vicinity of Knoxville, the most southern of which is now the Little Tennessee River. Near the southern boundary of East Tennessee, a stream flowed across that section in about the same location as the present Hiwassee River. This ancient stream flowed northwestward, crossing present Walden Ridge where the Tennessee now crosses it. It flowed into a stream which flowed southward through the region near the present Sequatchie Valley.⁶

These ancient rivers were older than the Unaka Mountains. As the diastrophic forces from the southeast bent the strata into folds, the streams maintained their direction, eroding the folds as they buckled across their beds. Thus, the present streams which cut down their channels as tributaries of these rivers of Paleozoic and Cretaceous time have their headwaters on the northwestern slopes of the Blue Ridge Mountains of western North Carolina, South Carolina and northern Georgia. They flow in a more or less direct north-

6. Johnson, D. W., Journal of Geology, vol. 13, pp. 194-234.

westward direction across the Unaka Chain. The Watauga, Little Tennessee, Big Pigeon, Little Pigeon, French Broad, Hiwassee, and Ocoee Rivers are remnants of the former rivers which emptied into the Mississippi Embayment.

The uplift at the close of Cretaceous time was accompanied by a slight tilting or warping toward the southwest, and the Great Valley of East Tennessee began to be formed by differential erosion. The lateral branches, subsequent upon the initial slopes, pushed their way back along the strike of the softer outcropping strata. Through the cutting back of these branches toward the uptilted area to the northeast practically all of the northwestward flowing streams were diverted to the southwest. The Hiwassee was the only river in East Tennessee to maintain its original northwestward course. The present Tennessee River is a tributary of the old Hiwassee that pirated the northwestward flowing rivers of the Tennessee Valley. As the westward flowing streams were pirated, their old channels were brought into relief as the valley was cut down along its longitudinal axis. Cumberland and Emory Gaps are mute reminders of the struggle of the northwestern flowing streams to compete with the rivers flowing to the southwest along the outcrops of the softer rocks.

The Geology of the Unaka Chain

In the Unaka Mountains, the strata were subjected to pressure which came from the southeast and greatly folded and faulted the beds which must have been originally almost horizontal. The beds now dip steeply in a general southeastward direction, and the broken edges appear at the surface. The structures are manifestly due to lateral compression which

began in early Paleozoic time and continued intermittently up to its culmination at the close of the Paleozoic era. In addition to these changes slaty cleavage planes were developed in the argillaceous rocks. The regional dip of these planes is from 20 to 90 degrees to the southeast. This form of alteration frequently destroys the original structure in the rocks. ⁷ The original structure and texture of the sedimentary and igneous rocks have been largely obliterated. The hard and resistant minerals were distorted and reoriented while the less resistant ones were altered into more stable forms. The new minerals consist chiefly of mica, quartz, and chlorite, and are arranged parallel to the cleavage planes. The metamorphism is more intense toward the southeast.

The structures above-described are chiefly the result of compression which acted at right angles to the general trend of the Appalachian Province. The cross folds and faults which appear at irregular intervals are due to compression at right angles to the main force. The earliest known period of diastrophism was during the Archean period. This and later movements resulted in the metamorphism of the Carolina gneiss, the oldest known formation in the area. Compression became effective again in Cambrian time, and continued intermittently until it culminated at the close of the Paleozoic era.

The Unaka Mountains are composed of igneous, metamorphic and sedimentary ^{rocks} peaks, all more or less altered since their formation. Some of them are very ancient. The oldest of all is the Carolina gneiss. It is distinct from, and immeasurably older than any other rock yet identified in East

7. Morristown Folio No. 27, U.S. Geological Survey, p. 4.

Tennessee. Masses of igneous rocks were forced into the gneiss and later intrusive bodies were forced into the earlier. The granitic texture of some of the formations and the lamination⁸ and schistosity of the others were produced at great depths.

Upon these deep seated rocks now rest lavas poured forth on the surface in Cambrian time. The more ancient, crystalline complex had undergone uplift and long continued erosion before the volcanic activity began. After a period of erosion, the land was submerged, and conglomerates, sandstones, shales, and limestones were laid down. These are classified as Cambrian or later in age. Remnants of these strata are infolded in the igneous and metamorphic rocks. Quartzite, slate, granite, gneiss, and conglomerate are the principal rocks of the Appalachian Mountains of East Tennessee. The result of combined hardness and inclined position is shown in narrow and steep-sided ridges, and sharp, high peaks with radiating spurs separated by narrow V-shaped valleys.

Geology of the Great Valley of East Tennessee

The Great Valley of East Tennessee exhibits the best section of Paleozoic stratigraphy in the world. The originally horizontal strata has been folded and broken by faults. The folds and faults extend in a northeast-southwest direction parallel to the old land mass to the southeast. The crests of many valley folds continue at a uniform height for a great distance. Often adjacent folds are very similar in height and length, which results in the reappearance of a given bed. The competent strata were slightly folded and the folding is greater in less competent rocks. A great

8. Greeneville Folio No. 118, U.S. Geological Survey, p. 2.

majority of the folds dip to the southeast at more than 10
9
degrees.

The faults were developed out of the close folds and, with extremely few exceptions, dip to the southeast. The planes on which the rocks broke and moved are often parallel to the bedding planes. The displacements of the faults are sometimes as great as four miles or more, with a progressive degree of deformation from northeast to southwest. Southwest of Knoxville, with extremely few exceptions, every major fold is broken, and the strata form a series of narrow over-lapping blocks dipping southeastward. The broken edges of these formerly almost horizontal beds now intersect the surface in narrow and long parallel belts, which causes the recurrence of the same strata a number of times.

Practically all of the rocks exposed in the valley are sedimentary. They present a record of almost uninterrupted sedimentation from early Cambrian to late Paleozoic. The sea in which these sediments were deposited covered most of the Appalachian Province and the Mississippi Basin. They are conglomerates, sandstones, shales and limestones. The conglomerates, sandstones, and sandy shales are largely valley uplands; the cherty limestones form broad ridges; and the more easily eroded limestones and calcareous shales underlie most of the
10
valleys.

Geology of the Cumberland Plateau

In the Cumberland Plateau the rocks are but little disturbed and retain most of their original characteristics.

9. Cleveland Folio No. 20, U. S. Geological Survey, p. 3.

10. Maynardville Folio No. 75, U.S. Geological Survey, p. 1.

There is little diversity of structure; there are no crystalline rocks, and no traces of intense metamorphism. The strata dip but a few feet to the mile, and their inclination is noticeable in only a few areas, namely along the escarpments bordering Sequatchie Valley and the Great Valley. The regional dip of the beds is south except near the mentioned escarpments, where the dip is steeply away from the valleys.

The Plateau is an erosional remnant rising about 1,000 feet above the lowlands on either side. The character and attitude of the underlying conglomerate, sandstones, shales and limestones are largely responsible for the preservation of the surface. The material of which they were composed were formerly gravel, sand, and mud derived from the waste of older rocks, or the remains of plants and animals. The rocks present a variety in appearance and composition. The gentle dip of the beds brings conglomerates, sandstones, and shales to the surface. The conglomerate and sandstone cap the escarpments and give sharpness of outline to its crested margin. They protect the softer shales of the interior surface from erosion. The remarkable uniformity of the surface is largely due to truncation of the outcropping strata by peneplanation.

The Sequatchie anticline is typical of the Appalachian folds, and is the greatest irregularity of the Cumberland Plateau. It extends from north of Crab Orchard Gap southwest to the lower end of Sequatchie Valley. The Crab Orchard Mountains are the unremoved northern part of this anticline. The hard practically insoluble rocks now forming the surface on either side of Sequatchie Valley formerly arched continuously across, so that a narrow ridge then occupied the position of

the present valley. The hard cap rock is underlain by limestones which were easily and rapidly removed by the work of underground water, caved in when the supporting limestones were dissolved and carried away, and a valley was formed. The ridge separating Grassy and Sequatchie Coves is an unre-
moved part of the Sequatchie anticline, as are the Crab Or-
chard Mountains further to the northeast.¹¹

Other irregularities of the Plateau are the residual hills and Elk Fork Valley. The residuals were unreduced low hills on the Cretaceous plain. Elk Fork Valley is a second cove interlocked with the arms of the table-land. It is due to faulting. The force that folded and faulted the strata of the great valley broke a great oblong block from the body of the Cumberland Plateau and pushed it towards the northwest. The northern and western edges of the block were turned upward until they were almost vertical as in Pine Mountain. The fault zones were rapidly eroded, and the cove was formed by stream erosion.

11. Safford, James M., Geology of Tennessee, pp. 62072.

THE EFFECT OF PHYSIOGRAPHY ON ECONOMIC DEVELOPMENT IN EAST TENNESSEE

Agriculture

East Tennessee is primarily an agricultural district. As a rule the productive land lies in the valleys and coves, and the forest and waste lands occupy the rugged portions of the Unaka Mountains, the ridges of the Great Valley, and large areas of poor soil on the Cumberland Plateau. There are exceptions to this rule; the knobby lands in the northeastern part of the Tennessee Valley are farmed on top, patches of hill land in all parts of the Valley are in crops; steep slopes in the Unakas are tilled, and there is some good farm land on the Plateau.

The agricultural landscape of East Tennessee presents three major and many minor contrasts. This marked variation results from many factors, but it is closely related to the diverse agricultural conditions. These conditions vary with soil, topography, and drainage, which depend largely upon the character of the underlying rock formations.

The Unaka Chain comprises approximately 2,000 square miles and constitutes the highest and most rugged division of East Tennessee. The mountain ranges are densely forested except where wasteful lumbering, fires, and small clearings¹ have destroyed the forest cover. The metamorphic rocks of this region weather slowly into a thin soil that is carried down the steep slopes to form the small fertile flood plains. Slopes with gradients of from 25% to 35% are often temporarily

1. Glenn, L. C., Professional Paper No. 72, U. S. Geological Survey, p. 18.

put under cultivation. These slopes waste ruinously and gullies are rapidly formed. They become useless in a short time.

The Great Valley of East Tennessee is the largest and richest agricultural division of East Tennessee. In passing from northwest to southeast marked variations in soils and farming conditions are readily noticeable. The prevailing soils range in color from light gray to dark red, and in texture from loam to clay loam. Many of the valleys are fertile, while the adjacent valleys are poor and relatively uninhabited. Some of the hill lands are highly productive, and the opposite character of others is evident immediately. From northeast to southwest, along the strike of the outcropping rocks, the soils are remarkably uniform and occur repeatedly in long narrow belts. This diversity in the former direction and uniformity in the latter is the result of the parallel arrangement of the underlying strata.

The soils of the Tennessee Valley may be divided into four types upon the basis of fertility, which largely depends upon the parent rock formation.² The most productive in the Valley are the larger flood plains, which are practically all utilized for agriculture. Their soils are fluvial and are not derived from the underlying formations, but from the rocks further upstream. The limestone valleys and the low ridges are second to the alluvial flood plains in fertility. The most important limestone areas are those derived from the Knox Dolomite formation. This formation occupies about one-third of the surface area of the Valley. It weathers into deep, fertile, red soils, largely loam or silt loam containing

2. Case, Earl C., The Valley of East Tennessee, pp. 5-6.

more or less chert. The soils of the long, chert ridges and their associated spurs are less productive than the valley lands. In the valleys the supply of nitrogen and phosphoric acid is small, the lime fair, and the potash good. On the ridges the soils are deficient in all of these elements. Limestone outcrops of secondary importance are those of the Chickamauga formation. They occur in narrow belts within the Ordovician deposits and cover less than one-twelfth of the Valley. The soils derived from them, high in both silt and clay, are fertile as a whole, but have a tendency to form clods and the soils are often rocky. Other limestone soils, those derived from marble and miscellaneous limestones, are usually fertile.

The products of the limestone areas are diversified. The principal crops are corn, hay, and wheat. Clover, alfalfa, and other leguminous crops are grown extensively near the larger cities, near the better highways, and close to the lime producing centers. The more intensive production in these areas is due to the low cost of obtaining lime, fertilizer and the greater importance of the dairy industries. Truck farming is important near the larger towns and the cities. Tobacco is becoming more important year by year. Its development is greatest near Greeneville and Knoxville. Cotton is grown extensively in the southern part of the Tennessee Valley.

The soils derived from the Rome, Conasauga, Watauga, Nolichucky, Athens, and Sevier shales constitute a third type of agricultural land in the Valley. The outcrops of these shale formations cover about one-third of the Valley

floor. The soils are less fertile and more difficult to maintain than those derived from limestone. They are compact, shallow, and wash ruinously, increasing the area of waste land. The crops of the shale regions are like those of the limestone valleys and low ridges, principally corn, hay, cotton, wheat, and tobacco. The production of cotton and tobacco are local developments. The counties in the southern part of the Valley produce cotton and the districts around Greeneville and Knoxville produce large quantities of tobacco.

The rugged ridges constitute the poorest soil type in the Valley. They support a sparse population. Most of the high ridge land is in timber or in waste, but a small percentage is utilized for general farm land, orchards, truck farming, and tobacco.

On the Cumberland Plateau the soils are predominantly sandy loams derived from conglomerate, sandstone, and shale. These soils maintain a fair forest growth, but are lacking in fertility under continued cropping. Some of the more favorably located districts are easily cultivated and well suited to the growing of Irish potatoes, tomatoes, forage crops, peanuts, and fruits. The soils are usually less than four feet in thickness. They have a high silt content and are poor in lime. Sequatchie Valley is an exception to the general Plateau soil type. It is underlain and largely derived from limestones and its soils have the characteristic of the valley limestone soils.

Live Stock

The abundance of blue-grass pastures and water, com-

3. Mooers, Charles A., Bulletin No. 78 of Agricultural Experiment Station, vol. 19, pp. 51-66.

bined with a moderate temperature, a long grazing season, and ability to produce a variety of feeds make the Great Valley a natural live stock country. As a whole the Unaka Mountains and the Cumberland Plateau are not important live stock producing regions. The present development of the live stock industry in the Valley of East Tennessee is below what the natural advantages warrant. The Plateau can support more sheep than it now has, and sheep and swine can be raised in the Unakas in greater numbers without harming the soil.

a. Horses and Mules

Horses and mules are raised principally for draft animals. The mules are in greater demand, since they are better adapted to work during hot weather and require less feed. Within recent years the breeding of horses and mules has declined considerably, due to the competition of truck, automobile, and tractor.

b. Cattle

The Valley of East Tennessee is a natural dairy country. It is one of the oldest and best known Jersey Breeding districts in the United States, and there are excellent herds of Guernseys and Holsteins within the Valley. Conditions are favorable for the production of beef cattle throughout the Valley. The creamery industry has become one of the most important agricultural activities. Butter, cheese and ice-cream are products of the dairy, and poultry and swine production is partly dependent upon the dairy industry.

c. Swine

Tennessee ranks second among the southern states East of the Mississippi in the number of hogs produced. A large

corn production, abundance of water and shade, mild temperatures, and long growing seasons provide favorable conditions for the breeding of hogs in the eastern part of the State. A few hogs are to be found on most of the valley farms. In some of the rougher sections the hogs are left to range in the woods and on the mountain slopes. Most of the swine marketed are sold in Knoxville and Chattanooga, where they do not meet the demands of the packing houses.

d. Sheep

Sheep are raised on the Cumberland Plateau, in the Unaka Mountains, and throughout the Great Valley but especially in its northern part. The Plateau and Mountains are well adapted to the production of a limited number of sheep. The Valley can support three times as many sheep as it now does without injury to other live stock industries. Care must be used in all places to prevent overgrazing and consequent washing of the soils. East Tennessee occupies a strategic place in the production of early lambs. Further south lambs will never assume a position of great importance. East Tennessee lambs can be sent to market earlier than lambs further north. Sheep have been more uniformly profitable during the past twenty years than any other live stock.

e. Poultry.

The Valley of East Tennessee is the leading poultry producing district in the south, and controls market prices as far north as New York City. Greeneville and Morristown are the greatest poultry producing and shipping centers in the United States, and Knoxville is the largest hatchery center in the south. A train load of poultry leaves Morris-

town every week for eastern markets. No district offers greater natural advantages for poultry production than the Great Valley of East Tennessee. The railroads offer direct communication with northern and southern markets. The record train time from Morristown to New York City was made by a poultry train.

Forest and Lumber

Tennessee has 152 species of trees, the majority of which are present in East Tennessee. The Unaka Mountains and the Cumberland Plateau constitute the major forest regions of the state, and every county in East Tennessee has some forests. Indiscriminate grazing, clearing, and forest fires are the three chief factors preventing forest growth. Much of the valley land, and practically all of the Unakas with their steep slopes as well as large areas of the plateau⁴ should be left in woodland.

The Mineral Industries

The output of the mines and quarries of East Tennessee, although surpassed in value by the products of both factory and farm, is important. The per capita production compares favorable with that of the United States as a whole. The value of minerals produced in 1926 was about \$21,500,000. Their occurrence is widespread and varied, the variety being large for such a small area. East Tennessee has the following minerals used in modern industry; coal, iron, copper, zinc, oil and gas, barite, manganese, and others. The large variety lends a measure of stability to the mineral industry for they

4. Case, Earl C., The Valley of East Tennessee, pp. 36-44.

are seldom equally depressed at the same time.

a. Coal

The most important mineral industry in East Tennessee is the production of coal. The present day development of manufacturing, mining, transportation, and perhaps of agriculture could not have been obtained without cheap coal. All the railroads in the western part of the valley use this coal to a large extent for steaming purposes, and directly or indirectly it helps supply the railroads with freight. The coal fields of Tennessee are coextensive with the Cumberland Plateau. The topography and drainage of this region makes the mining of coal a relatively simple engineering feat. Over much of the area where the workable coal lies below the general level of the plateau, the stream gorges expose the coal seams in vertical cross sections. Along the Cumberland Escarpment, the mines are located near the top of the plateau, so that long inclines are necessary to carry the product to the railroads. Although the coal lies within the plateau, the outcrops and openings to the mines are largely in the face of the escarpment or along the sides of the stream gorges. These coal producing areas are connected with the industrial centers of the valley, by the Southern and the L. & N. Railroads and their tributary lines. They are not connected commercially with much of the plateau, and scarcely affect its industrial development.

The coal seams are interbedded with the sandstones of the Lee and Briceville formations. The nature of the seams varies greatly within the region. In the North the outcrops are extensive and uniform; in the South the seams are more irregular in thickness. The coal is mined by drift or slope

method. It outcrops all along the escarpment and the gorge like valleys afford suitable places to open the coal beds or seams. The Tennessee and Clinch Rivers parallel the eastern escarpment of the plateau at a distance of from five to fifteen miles in their lateral tributary valleys afford general gradients along which railroads are built into the coal field.

b. Iron

Iron ore deposits occur in two belts in East Tennessee. The eastern belt, containing limonite, hematite, and magnetite extends along the western edge of the Unaka Chain. Almost all of the late production of iron ore in East Tennessee was in the second belt following the Cumberland Escarpment and extending into Sequatchie Valley. The ore in this belt is mainly the red fossiliferous, oolitic hematite, known as "Clinton" ore and occurring in the Rockwood formation of Silurian age which extends from central New York to central Alabama. The outcrop of the "Clinton" ore is not continuous from Chattanooga to the northern border of the state near Cumberland Gap, but strips of outcrop fifteen to twenty miles long are found in that distance. The outcrop has been duplicated by folding and faulting throughout part of this distance, and covered by faults and folds in others. The Tellico sandstone of Ordovician Age and the Grainger shale of Devonian-Mississippian age carry red iron ore in small quantities.

The ore is favorably situated with respect to coking coal and flux, and the region has sufficient railroad communications with the markets in the valley and to the north and

5. Burchard, Earnest F., Bulletin 16, Tennessee Geological Survey, pp. 18-22.

northeast. Most of the production has been near Cumberland Gap, LaFollette, Rockwood, Dayton, Soddy, and Chattanooga, along the face of the plateau.

c. Copper

The copper producing district in East Tennessee, known as the Ducktown district, is an isolated mountainous basin in the southwestern corner of the state. The rocks of the Ducktown district belong to the Great Smokey formation of lower Cambrian Age. The area has undergone intense regional and dynamic metamorphism. The deposits of pyrite, chalcopyrite, and chalcocite are in an area six miles long and four miles wide, and are located on the dissected peneplain which occupies the central portion of the Ducktown Basin.

In the main the deposits are broadly tabular; some are lense shaped and most of them are curved. All are included in the Great Smokey formation. The outcrops consist of limonite with some kaolin, quartz and other minerals. This is the gossan ore below which is found three or four feet of chalcocite. Below the chalcocite is the pyrrhotite, pyrite, chalcopyrite, zinc blend, bornite, magnetite, and the gangue minerals.⁶

The district is surrounded by mountains. Highways communicate with the district were difficult to construct and the Hiwassee River valley and its tributaries valleys afford the easiest route to the outside markets. These routes were by land as the turbulent waters can only be navigated with difficulty.

6. Emmons, W. H., and Laney, F. B., Professional Paper No. 139, U. S. Geological Survey, p. 41.

d. Marble

Tennessee is one of the most important marble producing states, ranking with Vermont and Georgia. The output of Tennessee marble is confined to the Great Valley of East Tennessee. The district about Knoxville produces most of the output of the Valley but outcrops of good marble are scattered widely throughout the Valley. The chief deposits constitute what is known as the Holston beds which outcrop in approximately parallel belts over an area about twenty-five miles wide by one hundred twenty-five miles long. They vary in color from pink to grey and deeper shades of red to chocolate. The texture is mostly coarse, even granular, through the dark belts are often irregular and variegated. Beds of marble similar to the Holston occur in the Ottosee formation⁷ in the central valley areas.

e. Zinc

With one exception, the zinc deposits of East Tennessee are limited in their geographical distribution to the Great Valley. The zinc ores are formed, generally, in the Knox Dolomite formation of Cambro-Ordovician age, but the mines at Embreville were opened in the residual clay of the Shady limestone of Cambrian age, and at Evanston small, non-commercial deposits are found in the Rome formation. The Embreville mines are in the Unaka Mountains. The deposits in the Knox Dolomite are found at different horizons. Nearly all of the deposits are found in brecciated zones, below recrystallized dolomite. The mines at Mascot, Jefferson City and Embreville were the only zinc mines in recent operation. The

7. Gordon, C. H., Bulletin No. 28 Part I, Tennessee Division of Geology, pp. 28-31

minerals are sphalerite, pyrite, chalcoppyte, dolomite, and calcite. The sphalerite occurs in roughly parallel veins which conform to the strike and dip of the Knox Dolomite. The pyrite and chalcoppyte occur as small detached masses in⁸ either sphalerite or the gangue calcite and dolomite.

f. Bauxite

The Bauxite deposits of East Tennessee are relatively unimportant at the present time. The last mine to close was that in operation on Missionary Ridge near Chattanooga. It closed in 1921. Another mine near Elizabethton ceased operation in 1918. Most of the deposits or pockets of an acre or less scattered through the great Valley. Scientific study of the origins of these ores and their geologic horizons may afford a key to scientific prospecting for this aluminum ore.

g. Manganese

The commercial manganese deposits of East Tennessee are mostly restricted to Sevier, Bradley, Johnson, and Carter Counties. The ores of Bradley County are found in a limestone which lies immediately below the Tellico sandstone and probably is the Holston Marble formation of Ordovician age. The manganese ore was deposited in solution caverns in the limestone along the bedding planes. This ore of a high grade is also found in the residual clay. The belt in which ore may reasonably be expected is about 100 yards wide and about 7⁹ miles long extending southwestward into Georgia. Other deposits have been worked recently near Hampton in early Cam-

8. Secrist, Mark H., Bulletin No. 31, Tennessee Division of Geology, p. 26.

9. Purdue, A. H., Resources of Tennessee, vol. 8, No. 1.

brian rocks.

h. Barite

Barite is a common mineral and has a widespread range in geologic age and in geographic distribution. It is a common gangue mineral in metallic ore veins. It has been formed from aqueous solutions, and is not an original constituent of the rocks. The Sweetwater deposits are the most important in East Tennessee. The barite occurs in brecciated zones or bedded veins in the Knox Dolomite. The residual clay contains lumps and masses which are the mined mineral. Barite is present in quantity and has been mined in Monroe, Greene, and Sevier Counties.

i. Other Minerals

Cement is produced at or near Jasper, Kingsport, Knoxville and Chattanooga. There are many other favorable locations for cement plants in East Tennessee but the demand is not sufficient to justify another plant. The various limestone outcrops occur throughout the Valley, and one outcrop might serve a number of localities.

Clay suitable for the making of brick is found in practically every county in East Tennessee. However, the brick and associated industries are largely confined to the northern and southern limits of the Valley and the northern part of the Plateau. Chattanooga, Kingsport, Bristol, and Robbins are the most important brick and tile producing cities in East Tennessee. Clay bricks have been produced in various other parts of the valley for local use.

Manufacturing

The manufacturing industries of East Tennessee are

largely confined to the Tennessee Valley. Within the Valley they are scattered widely and are of considerable variety, due to the wide distribution and variety of raw materials within or near the Valley. Chattanooga and Knoxville are the leading manufacturing centers producing in value about two-thirds of the manufactured goods of the Tennessee Valley. The concentration of industry in these two cities is the response to large labor supplies and excellent transportation facilities. The important manufacturing industries of East Tennessee are: Textiles, lumbering and woodwork, iron and steel products, aluminum products, bricks, tile, cement, sulphuric acid and fertilizers, the milling of wheat, and marble working.

Although natural conditions are related to each of these industries, the relation of each industry to environment is in many ways distinctive. Proximity of raw materials is the important factor favoring the development of the cotton textile industry in East Tennessee, while the raw materials for the aluminum industry in East Tennessee are brought from distant parts of the world. Power is the chief item of cost in the fabrication of aluminum products and is abundantly supplied by the turbulent mountain streams. The rugged topography of the region affords a favorable setting for woodworking industries which utilize the hardwood grown on the ridges of the Great Valley, in the Unakas, and on the Plateau.

a. Textiles

The manufacture of textiles is a comparatively recent development in East Tennessee. It is almost entirely confined to the Great Valley. Knitting and spinning are the principal phases of the industry, though weaving, bleaching, and dying

are of increasing importance. The cotton textile industries are widely scattered throughout the Valley, with a notable concentration in Chattanooga and Knoxville. The industry has swept to practically every community of any size in the Valley and its associated coves. Elizabethton, Cleveland, Athens, Sweetwater, Johnson City, and Kingsport are textile centers of note. Elizabethton is the center of rayon production in East Tennessee, and woollens are fabricated in many of the towns. The important factors favoring the development of the textile industry in East Tennessee are: an abundance of water power both developed and potential, proximity to cheap coal, cheap intelligent labor, nearness to the cotton producing section of the United States, suitable water and efficient transportation facilities.

b. Lumbering and Woodworking

Lumbering and woodworking are among the important manufacturing industries of East Tennessee. At least 50% of East Tennessee consists of steep slopes and should be kept permanently in wood lots or timber. The timber from the mountains and plateau move down grade by streams, highways, and railways to the Valley for manufacture. The Valley has an intermediate position between the states to the north with a timber shortage, and those to the south with a surplus, and is relatively close to both. It is within a 200 to 300 mile radius of Cincinnati and its environs which constitutes a large lumber market. The proximity of both hardwood forests and large markets affords the lumber and furniture manufacturers of East Tennessee advantages seldom equalled in the United States. Almost every town and city have produced and shipped lumber in some

form. The larger lumber and woodworking establishments are located in or near Chattanooga, Knoxville, Johnson City, Kingsport, Bristol, Newport, and Athens. These woodworking centers are situated on railways and highways which extend eastward into the mountain district.

c. Iron and Steel Products

The manufacture of iron and steel products in East Tennessee are localized industries confined to the Great Valley. Plows and other farm implements have been produced in Knoxville, Chattanooga, and Harriman. Large boiler works are in operation in Chattanooga, and stoves are produced in Cleveland and Knoxville. Mining machinery and construction steel are produced in Knoxville and Chattanooga. Cars and general shop construction and repairs by steam railways are the principal industries at Etowah, Lenoir City, Coster, and John Sevier. Proximity of cheap coal and iron, and large markets are the favorable factors influencing the location of these industries.

d. Aluminum Products

The aluminum industry at Alcoa, near the foothills of the Great Smokies, was developed to utilize local resources. The proximity of an abundant supply of water power is the essential requirement. Cheap labor, and favorable location with markets adequately served by railroads are secondary. The ore is mined in Arkansas and South America, concentrated at smelters in East Saint Louis, extracted from the ore in the reduction plant near Alcoa, where it is made into sheet and other aluminum products at that place.

e. Sulphuric Acid and Fertilizers

Sulphuric acid is a byproduct of the copper industry at

Copper Hill and Ducktown which has become more profitable than the copper itself. Its manufacture was forced upon the copper companies to prevent further destruction of vegetation and the soil in the district, and to save the water power storage pools downstream from being filled with sediment due to excessive erosion. The location of the industry was determined by the location of the ore.

f. Brick

The clays along the Tennessee River are well suited for the making of brick. Operations are carried on near the outskirts of all the large cities. Chattanooga, Kingsport, and Bristol and Oliver Springs are the large producing centers in the Valley and the foothills of the Unakas. Robbins, on the Plateau produces excellent brick and tile in large quantities. Brick are produced for local consumption in many parts of East Tennessee.

g. Cement

There are many suitable places for the location of cement plants in East Tennessee. Suitable shales and limestones exist in many of the counties and coal is obtainable nearby. Cement has been produced in or near Jasper, Chattanooga, Knoxville, and Kingsport.

h. The Milling of Wheat

The milling of wheat became important more than half a century ago when East Tennessee was a big wheat producer. Wheat is milled in every city and large town in East Tennessee. Most of the wheat is now imported from Kansas, Oklahoma and other states of the wheat belt. Chattanooga, Knoxville, Cleveland, Athens, Sweetwater, Bristol, Kingsport,

Elizabethton, and Kingston are wheat milling centers.

1. Marble

Marble is mined in quantity in the civinity of Knoxville. This region is one of the largest producers in the world. The product is of an excellent quality and is extensively used for interior decoration. Most of the product is shipped to the northern cities by railroad. Large quantities of marble from foreign countries and other states of the United States are finished in the mills at Knoxville.¹⁰

j. Others

There are several localized industries in East Tennessee which have not been mentioned above. The Fulton Sylphon Company, at Knoxville, manufactures temperature gauges. It is the largest plant of its kind in the world. There are several canneries in East Tennessee, the best known being at Sevierville, Newport, Tellico Plains and Clinton. A tannery is located at Newport, and Kingsport has a Kodak plant as well as a book manufacturing industry. The location of these industries was influenced by the proximity of raw materials, a plentiful labor supply, and efficient transportation facilities.

10. Gordon, C. H., Bulletin No. 28, Tennessee Division of Geology, pp. 15-23.

THE INFLUENCE OF PHYSIOGRAPHY ON THE LOCATION
OF THE EARLY TRADE ROUTES OF EAST TENNESSEE 2

Buffalo Trails

The great game animals of the continent marked out the first great trails of eastern North America. The bison or American buffalo broke great roads through the Appalachian Province on the summits of the watersheds, compared with which the first Indian trails were but traces through the forests. Heavy, fleet of foot, capable of traveling scores of miles a day, the buffalo made his roads from northeast to southwest and from east to west on the high grounds as he migrated with the seasons and from feeding grounds to salt licks. Here the roads were swept free of debris in summer and of snow in winter. They mounted the ridges and descended from them on the longest slopes and crossed the major streams on the bars at the mouths of tributary streams. The bulk of the animal caused him to seek the firmer footing of the ridges rather than risk the occasional marshes and swamps along the flood plains in the valleys. The buffalo found strategic passageways through the mountains, and marked out the most practical portage paths between the heads of the great rivers. These paths are followed closely today, for instance by the Pennsylvania and the Baltimore and Ohio Railroads through the Alleghanies; the Chesapeake and Ohio through the Blue Ridge; the Wabash between the Maumee and Wabash Rivers; and the Southern and the Louisville and Nashville through Cumberland Gap. Most of the railroad tunnels in the Appalachian mountains and the Appalachian Plateau are directly under or near

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the buffalo routes over the divides.

The Trails of the Mound-Building Indians

The ancient Indian confederacies which tilled the soil and built great mounds undoubtedly traveled the ^{HIGHEST} highways of eastern North America. Between their great mounds the mound-building Indians must have had paths along the summits of the watersheds. Their heaviest seats of population were located in the parts of the interior of the continent where heavy populations and rich lands are found today. They constructed no roads between their forts, but about their mounds they built great graded roadways commensurate with the size of the works of which they were a necessary part. The roads were used in the construction and maintenance of the mounds. The trails along the watersheds were used for communication between their ² centers of population. The trails were often coincident with the buffalo roads, and were in alignment with them throughout most of their courses.

The Trails of the Later Indians

The later Indians built no such roads as did their fore-runners nor did they maintain the works they found. The war and trading paths of the later Indians followed expeditious and stable courses to their objective points. In eastern North America, great Indian routes offered connection from tidewater to the Mississippi River and from the northern limits to the southern extremities. They led by short practical courses to strategic points. Their trains westward marked

1. Hulbert, Archer B., Historic Highways of America, vol. 3, pp. 1-25.

2. Hulbert, Archer B., Historic Highways of America, vol. 1, pp. 44-46.

paths of least resistance across the first divide as is shown by the adoption of these routes by modern railway systems and highways. There is no trunk railway and no important highway across the Appalachian System that is not in alignment with an Indian thoroughfare, which in turn closely followed the roads marked by the buffalo. For example the Old Connecticut Path ran from Boston to Albany and is now closely followed by the Boston and Albany Railroad; the Iroquois Trail ran from the Hudson to the Niagara Rivers and its course is paralleled by several railway lines including two of the greatest in the world, the New York Central and the Pennsylvania. The Warriors' Path through Virginia and the northern part of the Great Valley of East Tennessee is paralleled by the Carolina Clinchfield and Ohio, the Southern, and the Louisville and Nashville throughout parts of its course.³

Indian Trails in East Tennessee

Several great Indian routes passed through East Tennessee. The Warriors' Path and the Great Path were the two most important, but Indian paths were found along practically all of the mountain streams in the Unaka Mountains of East Tennessee. There are, however, few traces of Indian paths in East Tennessee west of the Tennessee River. The major Indian paths of East Tennessee are roughly traced on the Map in the Pocket.

a. The Warriors' Path

The Warriors' Path entered East Tennessee northeast of Kingsport along the North Fork of the Holston River and

3. Hulbert, Archer B., Historic Highways of America, vol. 1, pp. 1-15.

followed the valley of the Holston southwestward for about 35 miles. This segment of the Holston Valley is about 3 miles wide and has been formed by erosion in the Knox Dolomite formation. Near Spiers the river turns westward for about 12 miles to the vicinity of Galbraith Springs. This part of the valley is only about one-fourth of a mile wide and lies across a series of minor ridges. Near Galbraith Springs the river turns southwestward but the trail held steadily westward leaving the river east of Galbraith Springs, and following the broad valley in which Tate Springs now stands. Near Rutledge the trail apparently passed over Clinch Mountain by way of Bunches Trace. It passed through Copper Ridge and Log Mountain through the gaps cut by Runcheon Creek. Thence the path passed between Comby Ridge and Lone Mountain along Ball Creek which it followed to near Tazewell. It ran northwestward from Tazewell to Cumberland Gap, following Indian Creek for a great part of the way. In the westward course of the trail between Spiers and Galbraith Springs a trail branched northward near Rogersville or Marble Hall. It crossed Stone Mountain at its lowest point in the section and passed over Clinch Mountain probably through Big War Gap. Copper Ridge is much dissected, and a gap cut by Big War Creek offered easy passage through the bold War Ridge to the Clinch River. The trail followed Big and Swan Creeks in a general westward direction for about seven miles crossing a series of comby parallel ridges. Thence it followed the valley of Sycamore Creek southwestward for a few miles, and passed westward around the end of Powell Mountain to the vicinity of Tazewell where it rejoined the other braid

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of the great trail.

The location of this great Indian war and trade path was profoundly influenced by topographic features of the area, and it followed short practical routes from Kingsport to Cumberland Gap. The Holston Valley, which is a segment of the trail followed for 35 miles southwestward from near Kingsport, is bounded on the southeast by the Bays Mountain group of high ridges. The valley is bordered on the northwest by rugged hilly country and a series of great echeloned ridges including Stone Mountain, Clinch Mountain, Newman Ridge, Powell and Wallen Mountains. The river meanders within its deep valley. The Warriors' Path partly followed and partly truncated the meanders thus taking advantage of the gentle slopes in the valley. In the segment of the valley between Spiers and the vicinity of Galbraith Springs the river cuts across the ridges and valleys. The river valley is usually less than one-fourth of a mile in width, and the truncated ends of the ridges abut upon it. There are fewer meanders in this westward flowing part of the Holston River, and the trail paralleled the river closely. In that part of the Great Valley of East Tennessee between Rogersville and Tazewell the ridges are high and bold, and the longitudinal valleys long and narrow. There were two practical routes between these points and the great trail branches to follow each of them. The two braids of the great path followed routes that can scarcely be improved upon today. They passed the ridges through gaps, usually following the valleys to reach them. In many cases, they passed between the linear series of ridges and de-

4. Ramsey, J. G. M., Ramsey's Annals of Tennessee and Fain's Index, pp. 87-88.

toured around the ends of the higher ridges which terminated rather abruptly within Tennessee. The part of the great path between the vicinity of Tazewell and Cumberland Gap lay across a country maturely dissected by the Powell River and its tributaries. The trail threaded its way through this region taking advantage of the valleys of Gap and Indian Creeks.

b. The Great Path

Between Spiers and Galbraith Springs, a much used trail turned southwestward to the vicinity of Chattanooga. It followed the broad valley where Morristown now stands and followed down the valley of Dumplin Creek to the French Broad River. It crossed the French Broad near the mouth of Boyd Creek. The path paralleled Boyd and Ellijoy Creeks to the Little Tennessee River which it crossed near the mouth of the Tellico River. Southwest of the Little Tennessee River, it followed up the valley occupied by Island Creek and crossed the low and indistinct divide to Chestnee Creek which it followed to the Hiwassee River. In the vicinity of Benton the great trail swung westward to the vicinity of East Chattanooga, although a branch continued southward into Alabama.⁵ Below Chattanooga the route was in general alignment with the Tennessee River for a few miles but the trail continued southwestward where the river bends toward the north. It followed the valley of Lookout Creek to the vicinity of Wauhatchie and turned westward along the gorge cut by Running Creek to Sequatchie Valley. It crossed this great cove in a general westward direction and ascended the Plateau by way of Battle Creek Valley.

5. Ramsey, J.G.M., Ramsey's Annals of Tennessee and Fain's Index, p. 88.

The Great Path paralleled the trend of the topography from below Rogersville to the vicinity of Benton. It followed one trough occupied by a number of streams for this distance of approximately 128 miles. This trough enters Tennessee near Conasauga, and extends northeastward to above Rogersville. In this distance it crosses the great northwestward flowing streams which enter the Tennessee River as well as that of the Holston west of Spiers. The trough consists of the basins of several longitudinal streams which enter the northwestward flowing rivers from the southwest or northeast and one valley which is drained by underground channels. The trough has been formed by erosion of the Knox Dolomite and the Nolichucky shale. The divides between the valleys of the longitudinal stream valleys are usually low and are often indistinct. The great trough varies in width from less than one to more than five miles. Its width depends upon the size and velocity of the streams and the character and attitude of the underlying rocks. The trough is bordered on the southeast by a linear series of great barrier ridges, the continuity of which is broken only by the canyon-like valleys of tributaries of the Tennessee River. Bays Mountains form the southwestern limit of the trough for more than 30 miles southwestward from Rogersville. They are made up of Bays sandstone and are much dissected. The so-called slate knobs of Sevier and Blount Counties are the southeastern boundary of the trough for miles. They are composed principally of Tellico sandstone and Rome shale. Chilhowee Mountain and Starr Mountain form the southeastern limits of the trough for scores of miles north-

eastward from Benton. The trough is bounded on the northwest by one long ridge which extends from near Rogersville to Climer. It is often more than 200 feet above the valley floors but is much dissected and does not constitute the great barrier that Starr and Chilhowee Mountains do on the southeast where they often rise more than 1,000 feet above the streams. The Indians that followed the trough did not find it necessary to cross a ridge of any great height in the 128 miles of its southwestward course. The path followed the gradients of the streams and crossed the divides at their lower and more indistinct parts. Through the rolling or rugged parts of the trough the trail was winding in its course and sought out the gentler grades.

The part of the great trail between Benton and Chattanooga lay across the trend of the topography. This part of the Great Path was about 40 miles long, and it crossed one major and many minor ridges. It threaded its way through the gaps in the minor ridges and through Julian Gap in White Oak Mountain. Then it probably passed north of Missionary Ridge to the Tennessee River, following the stream past the foot of Lookout Mountain and leaving it to follow the valley of Lookout Creek to below Wauhatchie. This segment is parallel to the ridges and valleys of the section and follows the stream valleys closely. The slope is almost negligible, even along the foot of Lookout Mountain. The gentle grades are the result of stream erosion and deposition. About two miles below Wauhatchie the trail turned again westward along the gorge occupied by Running Creek and crossed Sequatchie Valley to the

vicinity of South Pittsburg. This part of the long trail lay across the practically horizontal strata of the Plateau and the folded rocks of Sequatchie Valley. It passes through the high and relatively unbroken front of the Cumberland table-land by what is generally accepted as the best route. The path ascended the Plateau proper up the gorge cut by Battle Creek. In passing through Walden Ridge and ascending the Plateau the route made use of the most practical as well as the shortest feasible route penetrating the table-land.

c. The Loop Through Tuckaleeche Cove

The great trail from the vicinity of Kingsport to Chattanooga branched at several places along the course to the southwest. The northernmost important tributary branched from the main trail about nine miles southwest of the present town of Rogersville. It probably followed the valley of Bent Creek to the French Broad River which it paralleled in its southwest course to the vicinity of Dandridge. It crossed the French Broad near the mouth of the Little Pigeon River. It then followed the Little Pigeon in a southward direction before turning southwestward along tributary streams to and across Wear Cove. The trail then ascended the watershed into the basin of the Little River, down the streams of which it followed to Tuckaleeche Cove and the Indian towns there. It left Tuckaleeche Cove in a northwestward direction along the canyon-like valley of the Little River. After passing through Chilhowee Mountain, it rejoined the Great Path. This trail made a great loop through a rough region but it adjusted itself to every natural feature in the section. The valley of Bent Creek pre-

vided an easy course through a knobby region to the valley of the Nolichucky River. The poorly defined, incoherent ridges are barriers to trade in any direction; the long and well-defined ridges are an obstacle only if the route lies across them. The path did not follow the Nolichucky along its sweeping meanders, but pursued a much more direct course by cutting across the meanders. It also truncated the meanders of the French Broad River to the vicinity of Dandridge. It crossed the French Broad on the bar at the mouth of the Little Pigeon. The valley of the Little Pigeon offered the only practical route to Tuckaleeche Cove from the vicinity of Dandridge. Its gorge is the only break in the continuity of Chilhowee Mountain for miles in either direction. The Little River Valley is roughly parallel to the Little Pigeon, but their tributaries branch toward each other and the basins are separated by a relatively low divide. The Little River Valley is the only logical route from Tuckaleeche Cove to the Great Valley of East Tennessee. The path followed by the Indians penetrated the foothills of the Unaka Mountains by way of the river gorges and took advantage of the limestone valleys, coves, and gaps in its course through the mountainous region.

d. The Path Through Tellico Plains

Another route turned southwestward along the Little Tennessee. The route branched at the mouth of the Tellico River, the most used route following the Tellico in a southerly direction. The branch route probably followed the Little Tennessee River gorge of the Little Tennessee into North Carolina. A path across this part of the mountains would naturally follow

the river closely. The path along the Tellico made its way into Tellico Cove by following the valley closely through the Red Knobs. Then it crossed the cove known as Tellico Plains and ascended the mountains, probably following Wild Cat Creek Valley. It passed near Coker Creek and followed the Hiwassee through into North Carolina. This great trail continued southeastward up the Hiwassee River into South Carolina and down the Saluda River to Charlestown. The path was strategically located. It penetrated the foothills up a river valley and crossed one of the flattest upland areas in the mountains. It crossed into North Carolina through a gap about two miles above the Hiwassee River.

e. Other Trails

The Hiwassee and the French Broad Rivers were followed by Indian paths which probably reached into North Carolina. A branch of the trail to Tellico Plains followed the valley of the Hiwassee River. There were important Indian towns in the vicinity of Benton. The French Broad is known to have been followed for a part of its course by Indian paths, and it is logical to suppose that trails followed all along the Tennessee part of the river and into North Carolina. Trails ran into the smaller coves in the mountains but were probably used mostly for hunting. Hunting traces were found in many parts of the valley. The more used trails discussed above were war trails as well as trade routes. The Indians produced similar products but they did carry on some commerce. Gold from Colorado and copper from Michigan found their way into many parts of the South. The Indians must have traded pelts, salt, and ornaments as well as foodstuffs. The trails or paths over which this limited

commerce passed were about as well adapted to topography as the trade routes of the modern day. Wherever practical they paralleled the trend of the ridges and valleys of the Great Valley. In crossing the trend of the topography the trails crossed every high ridge at one of its lower points, usually a wind or water gap. They frequently threaded their way along the longitudinal valleys, and through or around the ends of the ridges.

Trails of the White Man

The white traders ventured westward on the trails the Indian and bison had traveled. The first great roads built westward were opened under the direction of the trading companies. Captain Cresap built a road from the Potomac to the Ohio for the first Ohio Company, and Daniel Boone built the road from Virginia to Kentucky known as the Wilderness Road for the Transylvania Company. These "roads" were only widened and blazed Indian trails. The armies which conquered the old West followed the Indian trails. Washington followed Nemacolin's Path across the mountains when he hauled his swivels to Fort Mifflin in 1754. Braddock followed the same path in the following year, making a deep cut of a road that can be traced today. Forbes, Bouquet, Lewis, Shirley, Sullivan, Clark, Brodhead, Crawford, St. Clair, Wayne, Harrison, and the other military leaders followed the Indian trails and fought their battles beside them. Their campaigns were not
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by water but by land.

The nearest and most important of the East Tennessee Indians to the Carolinas and Virginia were the Overhill

6. Hulbert, Archer B., Historic Highways of America, vol. 1, pp. 11-24.

Cherokees. They lived in a number of towns along the fertile valleys of the Little, Little Tennessee, and Tellico Rivers. James Needham and Gabriel Arthur, the first white men of record to enter this territory, found that the Indians had already been trading with the Spanish in Florida. They also found that the Indians obtained white man's goods from the Virginia traders through the Ocooneeche Indians, who conducted a profitable business as middlemen. A lucrative trade developed between the Indians in East Tennessee and the white traders from South Carolina and Virginia. Peltry was the chief Indian product. The pelts were tied in bundles averaging 150 pounds, and loaded on pack horses. As a rule the traders made the journey to Charlestown, South Carolina, or Virginia at the same time for mutual protection. They followed the Indian trails to their destination. In the late Summer or early Fall, they returned to the Indian country. The imported goods consisted mostly of guns, powder, flints, knives, bullets, hatchets, clothing, ornaments, hoes, scizzors, and awls. Salt, tea kettles, and mirrors were in great demand and fetched fancy prices.

The pioneers made their way into East Tennessee over the trails the buffalo, Indian, and white trader had followed. They came in thousands from New York, Pennsylvania, Virginia, and North Carolina. The roads the pioneers followed into and across East Tennessee did not follow the trails exactly, but they were in general alignment and only deviated from the Indian routes in rough details of the topography. The trails were worn into wide, deep-rutted roads. Many of the pioneers came into East Tennessee through western Virginia and down the

valley of the Holston River. Some came by Flour Gap and the lower counties of Virginia. The great routes from North Carolina were down the French Broad River and the road connecting Burke County N. C., and the Holston settlements, built down the Watauga. Two routes to the settlements in Middle Tennessee passed through East Tennessee. One was the river route. The land route ran westward from the vicinity of Kingston to Nashville, a distance of 183 miles. During the colonization period of the Upper Tennessee Valley supplies which could not be produced in the new settlements were brought into the territory, for the most part, by wagon lines from Philadelphia, Baltimore and Richmond. Knoxville soon became and has since remained an important distributing point.

The trails of the Indians were adopted by the whites in their penetration and settlement of East Tennessee. They became wider and deeper with the greater usage. It has been estimated that 300,000 wagons passed through Cumberland Gap within a period of ten years. The wheels of the wagons ploughed great furrows where paths had been followed by the Indian. In some parts of the routes the roads were braided. The roads of the earlier settlers were one and the same with Indian trails as far as the influence of topography is concerned.

WATER TRADE ROUTES IN EAST TENNESSEE

History

The river valleys were the highways followed by the pioneers into East Tennessee. The settlers from the northeast came into the section mostly along the Holston River Valley, and some of them floated down the river on rafts. Pioneers from the Carolinas crossed the mountains by way of the river gorges. The earlier settlements were established along the rivers in the northeastern part of East Tennessee, and the country developed downstream. The rivers provided the most practical means of transportation in the early days, although many of the products of the new territory were carried overland into Virginia. Rafts and canoes were the first craft on the Tennessee River System. As the settlements grew and multiplied in number, water craft were improved to meet the greater and more varied demands. The flatboat and keelboat followed the canoe and raft. The products of the upper Tennessee Valley were usually sent downstream to settlers who had established trading posts among the Indians.

The people of the hills of East Tennessee were forced to use the rivers for transportation. Supplies were carried by water from the Clinch River to General Andrew Jackson in Northern Alabama and again in New Orleans. In the early days of the marble industry in East Tennessee, the marble was floated down the river on flatboats. That used in the capitol building in Washington was shipped by water from Hawkins County to Chattanooga and thence overland to Charlestown, South Carolina. In at least one instance a large keelboat was portaged across the watershed between the Tennessee and Alabama River

Systems. The keelboat, the "Tennessee Patriot", was fifty feet long, six beam and six deep. The cargo consisted of flour and whiskey. The boat and cargo were carried overland from the Ocoee River, a tributary of the Tennessee, to the Conasauga River which flows into the Gulf of Mexico near Mobile, Alabama, by way of the Oostanala, Coosa, and Alabama Rivers.¹ Several months were required to build and load a flatboat, float it to New Orleans, sell the cargo and return. The return was usually made by land or canoe. The flatboats could not be profitably navigated upstream and the keelboat was designed to meet the demand for upstream navigation. The keelboats and flatboats comprehended the best means for using the streams as a facility of transportation, at that time.

Contemporary with the establishment of flatboat traffic was the era of the Tennessee Raftsman. Logs were cut in the mountains, formed into rafts and floated down the streams to the sawmills. At one time the lumber trade was one of the greatest industries in the Tennessee Valley.

The first steamboat to enter East Tennessee, the "Atlas", came up the Tennessee River in 1828. The first river steamers to operate in East Tennessee earned little or no profit.² Traffic developed slowly, but by 1840 the steamboats had become the principal transportation facility. However, when the railroads penetrated the valley the steamboat trade began to wane. Railroads built at right angles to the river were not serious competitors, but when the East Tennessee, Virginia and Georgia was completed between Bristol and Chattanooga the boats began

1. Campbell, T. J., The Upper Tennessee, p. 6.

2. Campbell, T. J., The Upper Tennessee, pp. 9-16.

to feel the effects of a divided traffic. Responding to the urge for speed the passengers quit the boats for the trains. The freight was soon diverted to the faster railroad trains. The rivers continue to be used in a gradually lessening degree for the floating of timber, but river traffic has become obsolete in East Tennessee. (See Plate III.)

The Tennessee River and some of its tributaries were important means of transportation for decades. (The major streams of East Tennessee are shown on the map.) They provided the only available outlets for heavy and bulky products. None of the streams in East Tennessee afforded navigation for large loaded craft at low water, and it was necessary to wait until the rainy seasons raised the water. The different streams, because of varying degrees of ruggedness, required different stages of high water for navigation. The rapid run-off of the rainfall in the section made transportation by water very dangerous in flood stages and many of the boats were wrecked and their cargoes lost. There were only a few boating stages per year and often much of the produce of the valley was left on the farms. Transportation by water was uncertain and extremely hazardous over the entire length of the tributary streams of the Tennessee River, and over many of the shoals of the latter.

Tennessee River System

a. The Tennessee River in East Tennessee

The Tennessee River is formed by the junction of the Holston and French Broad Rivers about four and one-half miles east of Knoxville. Thence it flows west southwestward to



Plate III. Log Rafts on the Tennessee River.

Loudon an airline distance of nearly forty miles. As a rule the valley is four or more miles in width in this section of the river and the stream meanders within the limits of the valley. Near Loudon the River turns slightly north of west to its union with the Clinch River south of Kingston. The valley of the Tennessee in this part of its course is narrow, usually less than one mile. It lies across the ridges and valleys of the section, and their truncated ends abut upon its valley. The Tennessee turns southwestward after it is joined by the Clinch, and follows a great longitudinal trough to the foot of Lookout Mountain. The valley is eroded in the Knox Dolomite, Chickamauga limestone, and Rome formation. Its width varies from less than five to more than ten miles. The river meanders within its valley as far south as the mouth of the Hiwassee River. South of the Hiwassee, the Tennessee is more direct in its course. Below Chattanooga, the river leaves the broad valley. It sweeps past the foot of Lookout Mountain, and bends back northwards for about five miles, before turning westward to enter the deep, narrow, and winding gorge of the Tennessee River through Walden Ridge. Emerging from the gorge, the river runs diagonally across the Sequatchie Valley to near South Pittsburg where it turns southwestward and enters Alabama.

The part of the Tennessee River in East Tennessee is about 250 miles long. It is less than 25 miles between South Pittsburg and Chattanooga by airline, but the sweeping meanders of the river at least double the distance. The section of the Tennessee River above Chattanooga is about 190 miles long and has an average fall of slightly less than one foot per mile. It consists of a series of pools where the slopes are less than

average, separated by shoals which usually consist of gravel and boulders that are supported by the rock formations outcropping across the bed of the stream. Where the stream widens, sand and gravel are deposited due to the loss in velocity. The Tennessee is mostly parallel to the outcropping strata and has eroded its valley principally in the Knox Dolomite and Chickamauga limestone. Parts of its course lie across the trend of the topography, diagonally crossing the parallel outcrops. It is in these parts of its course that the shoals are most often encountered. (Muscle Shoals in northern Alabama forms a serious obstacle to navigation and for years divided the river into two parts.)

b. Major Tributaries

The Holston River flows southwestward from its headwaters near Tazewell, Virginia, to its union with the French Broad River about four and one-half miles east of Knoxville. The basin has an extreme length of approximately 170 miles. The valley of the Holston River is about four miles wide in the first thirty-five miles of its course in East Tennessee. The valley is eroded in Knox Dolomite, Chickamauga limestone, and calcareous shales. The river runs in a general westward direction between Spiers and Galbraith Springs. This part of the valley is narrow, usually less than one-half mile. It lies across the ridges which have been cut across by the river. The river resumes its southwestward course to the vicinity of Knoxville after passing Galbraith Springs. The Holston River follows the longitudinal outcrops of the Great Valley throughout most of its course. It, like the Tennessee, meanders irregularly. It is of little use as a navigable stream. How-

ever, in the "old days", Kingsport was the head of navigation and boat building was its principal industry.

The Clinch River flows southwestward from Tazewell, Va., to the Tennessee River which it enters about three miles below Kingston, Tennessee. Its basin is about 160 miles long and is relatively narrow. The stream meanders irregularly in its narrow valley which is eroded in calcareous rocks. The Powell River is the only tributary of any great size to join the Clinch River. It flows southwestward, roughly paralleling the Clinch which it joins north of Kingston. These southwestward flowing streams parallel the Cumberland escarpment at a distance of from five to fifteen miles. They have been used for the transportation of the products of the region, but at present are unimportant as carriers.

The great cove known as Sequatchie Valley is drained by Sequatchie River, a southwestward flowing stream which enters the Tennessee near South Pittsburg. The stream is confined to the narrow valley and, like the other longitudinal streams, meanders irregularly. It is not navigable.

The French Broad River has never been as any importance as a carrier of commerce, although many traders and settlers floated down the river on rafts in the early days. It rises in the Blue Ridge of North Carolina and flows northwestward through the Unaka Mountains and halfway across the Great Valley of East Tennessee to its union with the Holston River. It has carved a great canyon-like valley in the mountains, and its course is too tortuous and its waters too turbulent for navigation.

The Little Tennessee River has maintained its course

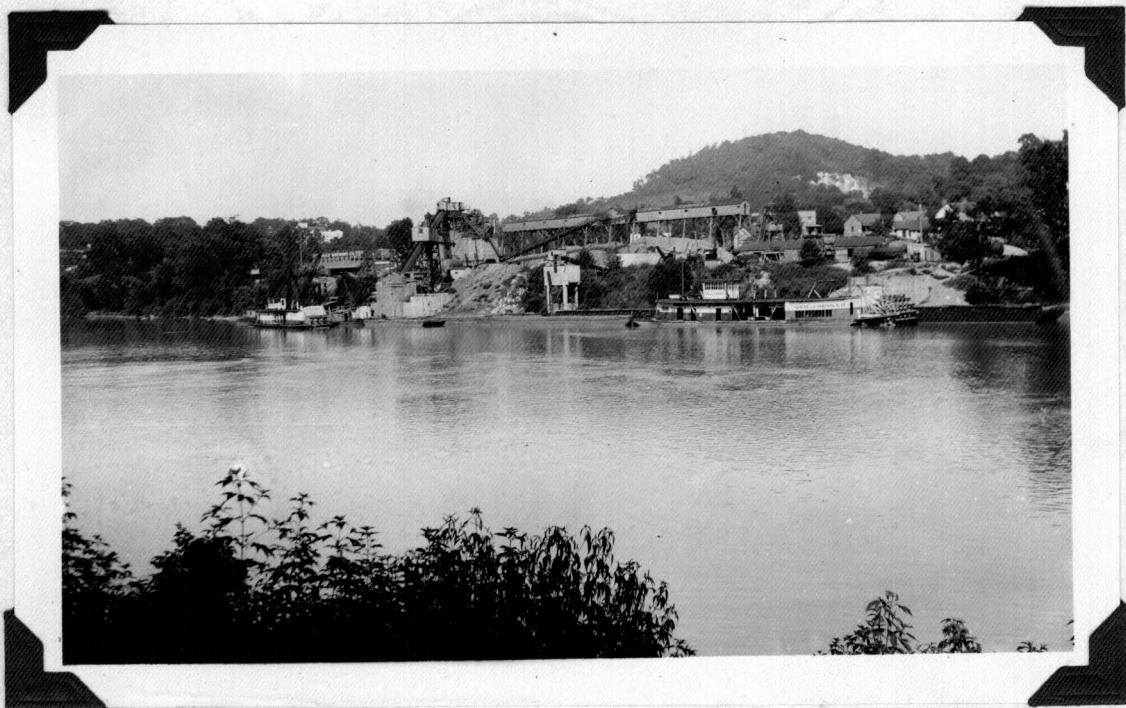


Plate IV. Sand and Gravel Boats on the Tennessee River.

northwestward through the Unaka Mountains. Its swiftly flowing waters are impractical for navigation on any scale. However, It has been used for the floating of timber.

The Hiwassee River is another river which is antecedent in its course through the Unaka Mountains. Like the French Broad and Little Tennessee Rivers, it flows through the mountains in a course that has been influenced only locally by geologic structure. In the part of its course across the Tennessee Valley it flows across the parallel outcrops of the folded and faulted valley beds. It has served as a navigable stream, but navigation was untrustworthy and has been discontinued.

Conclusion

Waterways provide the cheapest known means of transportation, but at the present time there is little demand for navigation on the Tennessee River and its tributaries. Waterways cannot meet the competition of the more certain and rapid railroad and highway carriers in East Tennessee. Navigation is uncertain and hazardous over all the tributary rivers of the Tennessee River and over many of the shoals of the latter. The present rapid rate of erosion in East Tennessee (due to deforestation) makes the construction and maintenance of a channel of any depth exceedingly difficult and very costly.⁴ It would be necessary to provide sufficient depth of water for navigation throughout the year if traffic is to be diverted from the railroads and highways. The economic structure of the modern world is largely based upon speedy transportation. The waterways in East Tennessee cannot meet this

4. Glenn, L.C., Professional Paper No. 72, U. S. Geological Survey, p. 82.

requirement, and may be relegated to the past, as long as speed is essential.

THE RAILROADS OF EAST TENNESSEE

The First Railroads in East Tennessee

The Hiwassee Railroad Company was chartered in 1836 for the purpose of constructing a railroad from Knoxville through the Hiwassee district to the southern boundary of the State. The road was surveyed and the ground broken in 1837. This was the first work done on railroad construction in the State of Tennessee. In 1848, the charter was amended and the name changed to the East Tennessee and Georgia Railroad. The road was completed in 1856. Two years later the East Tennessee and Virginia Railroad was completed. These two roads form a trunk line from Bristol to Chattanooga which was known for years as the East Tennessee, Virginia, and Georgia Railroad.¹ This railroad line is now the Bristol-Chattanooga Division of the Southern System. The Nashville and Chattanooga Railroad was completed in 1851. Thus, it was the first railroad operated in East Tennessee. Before the Civil War, every railroad project of consequence in East Tennessee, with the exception of the Nashville and Chattanooga, and the East Tennessee, Virginia, and Georgia, was an attempt to reach the Atlantic Seaboard. Others attempted to cut through the mountains and by the same token were unsuccessful. The Louisville, Cincinnati, and Charleston, the "Rabun Gap", the Atlantic, Tennessee, and Ohio, the North Carolina and Tennessee, the Cincinnati, Cumberland Gap, and Chattanooga, the Greeneville and the French Broad, and the Greeneville and North Carolina Railroads all failed. There were also projected

1. Garret, W. R., and Goodpasture, A. V., History of Tennessee, pp. 456-467.

several feeder lines to the north and west of Knoxville, which were to attempt to effect a passage through the plateau. Among these projects were the Nashville, Knoxville, the Knoxville - Kentucky, the East Tennessee and Kentucky Central. These links like the greater railroads which they were to supplement failed² of completion. The Unaka mountains remained unpierced by a railroad until the Southern line was laid along the French Broad River Valley.

The majority of the railroads in East Tennessee were built along the shortest practical courses available. Most of them parallel the valleys and ridges of the Great Valley of East Tennessee or follow the streams through the mountain and plateau sections of East Tennessee. These lie along natural avenues of human intercourse. On the other hand, there are several railroad lines which reach their objectives across the trend of Appalachian topography. These are characterized by winding courses and steep grades. The gaps in the ridges are of great importance in the location of the railroads built across the trend of the topography. (The railroad trade routes of East Tennessee are shown on the Map in Pocket).

Railroads Located along Natural Routes

The more important railroads of East Tennessee are, as a rule, more or less parallel to the northeast-southwest trend characteristic of the Appalachian physiographic province. In the part of East Tennessee south of the city of Knoxville, the four main railroad lines are northeast-southwest routes, and most of the branch lines are parallel to the

ridges and valleys. The Nashville, Chattanooga and St. Louis Railroad operates a line from below South Pittsburg to Pikeville. The Cincinnati-Southern Railroad, also known as the Cincinnati, New Orleans and Texas Pacific, parallels the eastern face of the Cumberland Plateau from near Chattanooga to Harriman Junction. The Southern Railroad line between Chattanooga and Knoxville passes along the middle of the Tennessee Valley. The Unaka Mountains are roughly paralleled by the main line of the Louisville and Nashville. The Alabama Great Southern, the Chattanooga-Southern, the Chattanooga, Rome and Columbus, and the Western and Atlantic Railroads operate lines from the city of Chattanooga into the State of Georgia. North of Knoxville, the Louisville and Nashville and the Southern are more or less parallel to the trend of the Appalachians from Caryville to Jellico. The two lines of the Southern from Bulls Gap to Bristol, one by Appalachia, Virginia, and the other by Johnson City, as well as the main line from Knoxville to Bull Gap are in general parallel to the ridges. Some parts of these railroads lie across the ridges and valleys, but in general they are parallel to them.

Nashville, Chattanooga, and St. Louis.

The trade route follows Sequatchie Valley. This valley is eroded on an anticline which has been carved in the Knox Dolomite and Chickamauga limestone. The railroad runs near the west or northwest escarpment bordering the Valley and does not follow throughout its course. The escarpments on either side of the Valley are approximately 1,000 feet above the valley floor. The floor of Sequatchie is similar to portions of

The railroads were traced on the Geological and Topographic Atlases of the United States.

the Great Valley. The road follows a natural route through the fertile valley.

Cincinnati - Southern.

There is a great longitudinal trough along the face of the Cumberland Escarpment, made up of a series of small valleys eroded in the northeast-southwest trending outcrops of Chickamauga limestone and other calcareous rocks. Throughout the greater part of its length it is followed by one or more railroads. The Cincinnati-Southern is the great carrier in this trough between Chattanooga and Harriman. It runs northeastward from Chattanooga to King Point along a broad and level valley eroded in Knox Dolomite and Chickamauga limestone. Near King Point the tracks turn northward along Chickamauga Creek for about six miles and then swing northeastward along the great trough adjacent to the face of the escarpment of the Cumberland Plateau. The valley occupied by north Chickamauga Creek is eroded in the Chickamauga limestone, the Knox Dolomite and the Bangor limestone. The smaller streams have eroded their valleys along the longitudinal outcrops of the weaker rocks and enter the major streams of the region at approximately right angles. At Rathburn the elevation is 788 and at Emory Gap 57 miles to the northeast it is 840, and average climb of less than one foot per mile. The railroad passes over the low divides between the valleys of the small streams but the slopes are scarcely noticeable. The Cincinnati-Southern occupies a remarkable natural route from Chattanooga to Harriman.

The Southern between Chattanooga and Knoxville

The Southern Railroad reaches Knoxville from Chattanooga

by way of Cleveland, Athens, Sweetwater and Loudon. The first part of its course, between Chattanooga and Cleveland, lies across the trend of the valley ridges. It passes beneath Missionary Ridge by a tunnel and passes White Oak Mountain, the major ridge of the Southern part of the Tennessee Valley through Julian Gap. It follows Little Wolftever Creek through another ridge and crosses the valley of Candy Creek to Black Fox. Here it turns northeastward for about six miles, passing through the city of Cleveland, then swings eastward for less than two miles. In the part of the course between Chattanooga and Cleveland, the railroad crosses the outcrops of several formations including the Rockwood formation, Chickamauga limestone, Knox Dolomite, Conasauga shale, Rome shale and sandstone, and Apison shale. The limestones and soft shales weather easily and form valleys. The more resistant beds form ridges.

Branches of the trunk Southern line in East Tennessee run southwestward into Georgia from Ooltewah and Cleveland. They are admirably adapted to the topography and follow their respective valleys from the main line in East Tennessee into Georgia.

About three miles east-northeast of Cleveland, the road turns northwestward along a general trough which it follows to the vicinity of Knoxville. The road leaves the trough for about two miles to contact the city of Athens. This trough is the result of erosion by small longitudinal streams along outcrops of Conasauga shale, Knox Dolomite, Chickamauga limestone, and other calcareous formations. The curve at Athens is on a broad cherty dolomitic ridge and the slope is not

steep. The railroad enters Knoxville below the general level of the streets in a trough eroded in a fault zone in the Knox Dolomite. The gradients of the longitudinal trough are gentle, and the divides low and indistinct. The valleys of Sweetwater, Muddy and Sinking Creeks have remarkably flat floors. As a rule, the course is gently winding, the curves following the contour of the topography as nearly as is practical.

The Louisville and Nashville.

South of Knoxville, the Louisville and Nashville Railroad is the important carrier in that part of the Great Valley adjacent to the mountainous section. This railroad enters the State of Tennessee from Georgia along the broad gently rolling valley northwest of the foothills of the Unakas. It parallels Conasauga Creek and follows the valley of South Chestusee Creek for about 25 miles. The trough is cut in the Knox Dolomite, Chickamauga limestone and Athens shale. The railroad passes through Benton in this part of its course. At Cambria a branch line follows the Hiwassee River valley southeastwards into the mountains. Near the North Carolina line, it turns sharply southward along a tributary of the Ocoee River through the Ducktown district and into Georgia. The stream valleys provide a practical route through the copper producing district of East Tennessee. North of Cambria the railroad follows Chestusee Creek past the south end of the Red Knobs. From near Greenback the road follows a more northerly course along Cloyd Creek through a gap in an unnamed Tellico sandstone ridge which is often more than 300 feet high but is much broken. From south of Kizer to near Louisville, it parallels the Tennessee River at a distance of about five miles, cutting across the sweeping curves of the stream. The road runs in a general

northeastward direction from Kizer, following the valleys of two small longitudinal streams to Knoxville. Beans, Starr, and Chilhowee Mountains, and the Red Knobs form the almost unbroken front of the Unaka Mountains. The streams, that flow through the mountains in a northeast direction, form natural gateways and routes through the mountains. Lines branch east or southeast along several of these natural routes. These will be discussed below.

Segments of Railroad Lines in Southern Part of East Tennessee

Several railroads run southward from Chattanooga to Georgia. The Nashville, Chattanooga and St. Louis and the Alabama Great Southern Railroads run southwest from Chattanooga to Wauhatchie on the same tracks. They follow the sweeping curve of the Tennessee River past the foot of Lookout Mountain in a westerly direction. The tracks follow the valley of Lookout Creek northwest of Lookout Mountain. The Alabama Great Southern follows this valley into Georgia; the Nashville, Chattanooga and St. Louis turns westward to Wauhatchie. The course of this route is mostly upon calcareous rocks. North of Lookout Mountain the rocks are Banger limestone exposed by the Tennessee River. Knox Dolomite and Chickamauga limestone make up the floors of the valleys along the rest of the route.

a. The Chattanooga Southern

The Chattanooga Southern runs almost directly southward along the valley of Chattanooga Creek, closely paralleling the eastern face of Lookout Mountain. The route lies along an outcrop of Chickamauga limestone, and crosses an outcrop of Fort Payne chert. The resistant chert bed has been lowered by stream erosion and does not form a serious obstacle. The route

offers a smooth direct course into Georgia.

b. Chattanooga, Rome, and Columbus

The Chattanooga, Rome and Columbus Railroad runs slightly east of south from Chattanooga into Georgia. Its course within East Tennessee lies almost entirely on calcareous rocks. The route obliquely crosses a broad outcrop of the Chickamauga limestone and crosses no ridges as it runs along the eastern side of the valley of Chattanooga Creek.

c. The Western and Atlantic.

The Western and Atlantic Railroad leaves Chattanooga towards the northeast over the Cincinnati-Southern tracks. At East Chattanooga, it turns southeastward along the valley of South Chickamauga Creek into Georgia. It cuts diagonally across parallel outcrops of Knox Dolomite, Chickamauga limestone, and Conasauga shale. The northeastern part of the course swings past the northern end of Missionary Ridge. The slope of Chickamauga Creek valley offers an almost imperceptible grade toward the southeast. The route is not the shortest possible, but has one of the best available grades from Chattanooga to the southeast.

The Plateau Segment of the Cincinnati-Southern

From Harriman, the Cincinnati-Southern Railroad follows the Emory River Valley into the Cumberland Plateau. For the first twelve miles the route runs towards the northwest. North of Memo the railroad tunnels an abrupt sandstone projection and turns in a general northeastward direction into Kentucky. The tracks from Harriman to Oneida are usually alongside a stream. They follow Rock Creek, Webb Branch, Wolf Creek, and Phillip Creek in succession from south to north. Between Oneida and

the state line the route follows the divides between stream basins, and crosses the valley of Roaring and Paunch Creeks. It follows a fairly direct course from Harriman to the state line, and is a continuation of the Chattanooga to Harriman route. It follows the gentlest grades to be found on the route to its objective points. The stream valleys form the natural course, and the divides between the streams are lower than the plateau proper. The plateau is maturely dissected in this section and has a mountainous appearance. The only practical route for a railroad is along the streams, which have eroded great valleys through the plateau. The divides between the streams are usually pierced by tunnels to modify the grades.

Railroad Routes Between Coal Creek and Jellico.

Two railroad lines are operated between Coal Creek and Jellico. Between Coal Creek and Caryville, a great natural route follows the trough paralleling the northwestward trending face of the escarpment of the Plateau. The great oblong block broken from the Plateau proper and moved to the northwest by the diastrophic earth movements of the past is practically encircled by railroads which may be said to be in accord with the topographic trend. The Louisville and Nashville follows the great trough adjacent to the escarpment of the Cumberland Plateau which extends all along its face through East Tennessee and beyond in both directions. At LaFollette, it enters the Plateau by way of the Big Creek Valley. Within the Plateau the railroad follows the streams throughout the greater part of its course to Jellico. It winds through the mountainous region, and never ascends the Plateau surface.

The other route follows the valley of Cove Creek in a northwest direction for about twelve miles from Caryville. It passes through Elk Gap and turns northeast down Elk Creek Cove to Jellico. The upturned edge of the great oblong block of the plateau exposed the calcareous rocks to erosion and the valleys of Cove and Elk Creeks were rapidly worn down. The floors of the valleys are gently sloping. They provide a natural trade route through the great coal field of East Tennessee.

The Knoxville-Bristol Segment of the Southern.

For more than fifty miles the Knoxville-Bristol Line of the Southern System follows a general valley without passing over or through a prominent ridge. It follows the valley of the Holston River to Strawberry Plains, and is in alignment with it to Whitesburg. The line in this part of its course lies entirely upon easily eroded rocks including the Chickamauga limestone, Knox Dolomite, Athens shale, and Holston marble. Near Whitesburg the tracks swing southeastward across outcrops of Bays sandstone and the Rockwood formation. These stand out above the general level forming Bays Mountain and other ridges. The tracks pass through Bulls Gap, probably the lowest cut through Bays Mountains. From Bulls Gap the course lies in a southeasterly direction, cutting diagonally across outcrops of Chickamauga limestone, Knox Dolomite, Athens and Sevier shales, and Homaker limestone. The shales are calcareous but contain some sandstone and form poorly defined ridges of no great height. The railroad winds in and out taking advantage of the gaps in ridges. It occasionally follows a dolomitic or limestone outcrop in a northeasterly

direction for a short distance. The route is probably the best available for a railroad between Morristown and Greenville. From Greenville the route follows a northeastward course to Johnson City, and then turns in a more northerly direction to Bristol. The ridges are incoherent and the railroad threads its way through them. It is in alignment with the Nolichucky River from Greenville to Jonesboro, and it follows the valleys of smaller streams throughout most of the remaining distance to Bristol. Indian and Whitetop Creek occupy well-defined valleys with gentle gradients, and smaller streams offer practical routes through the knobby region.

The Southern Line from Rogersville Junction to Appalachia, Virginia.

From Rogersville Junction, a branch line of the Southern System eastward into Virginia, a distance of approximately forty miles. It follows the well-defined valleys of Whitehorn and Honeycut Creeks to the valley of the Holston River. This part of its course lies through a knobby region, across outcrops of Sevier and Athens shales and Chickamauga limestone. The stream valleys offer short, practical routes through the region. From Austin Mill northeastward to Virginia the route follows the northwest side of the Holston Valley just beyond the convex meanders of the stream. It lies almost entirely upon Knox Dolomite. The relatively level floor of the valley offers gentle gradients into Virginia.

B. Railroads built Across the Trend of the Topography

The railroads often sacrificed distance to secure the gentlest possible gradients for the hauling of long and heavy trains. The lines which were built in general alignment with longitudinal troughs had the most practical routes and easiest

grades. The railroads that reached their objectives across the trend of the furrowed Great Valley, the rough Unaka Mountains and the bold escarpment of the Cumberland Plateau found the most practical routes were not necessarily the shortest. The principal railroads that in general lie across the Appalachian trend are the Nashville, Chattanooga and St. Louis, the Tennessee Central, the Southern between Knoxville to Coal Creek, the Southern from Knoxville to Cumberland Gap, the Southern from Knoxville to Asheville, and the Louisville and Nashville from Knoxville to Dosset.

The Nashville, Chattanooga, and St. Louis Railroad.

The Nashville, Chattanooga and St. Louis leaves Chattanooga in a southwestward direction and crossing Walden Ridge and Sequatchie Valley, it passes through the gorge of Raccoon Mountain occupied by Running Creek and crosses Sequatchie Valley. Walden Ridge is entirely dissected by only the deep and winding gorge of the Tennessee River, which does not offer a natural railroad route. Running Creek does not cut entirely across the arm of the Cumberland Plateau but it offers the only feasible route. The divide between Running Creek and the eastward flowing tributary of the Lookout Creek is a low gap and does not offer a serious obstacle to commerce.

The Southern Between Knoxville and Coal Creek

The segment of the Southern line between Knoxville and Coal Creek lies across the topography. It passes through Beaver, Copper, Bull Run, Chestnut and Pine Ridges as well as several smaller ridges before reaching Clinton. (The Gap in Sharp's Ridge is shown on Plate 7). The section between Clinton and Coal Creek is roughly rolling. In its course across

the parallel outcrops the railroad is winding. It passes through the ridges by way of water or wind gaps, but the road bed is distinctly undulating.

The Tennessee Central

The Tennessee Central runs from Knoxville to Harriman on the tracks of the Southern System. This division of the Southern is roughly parallel to the typical trend of Appalachian topography. From Harriman to below Rockwood, it follows the general trough along the face of the Cumberland Escarpment. Below Rockwood the tracks swing westward through a tunnel into the Plateau Region. It crosses Piney Creek Valley and follows Birch Creek through Crab Orchard Gap towards Nashville. The route to Middle Tennessee is across the relatively level plateau surface. The tunnel through the escarpment front makes a gentle grade available to the surface of the Plateau.

The Southern Between Knoxville and Cumberland Gap.

The Southern line extends between Knoxville and Cumberland Gap in a northerly direction and obliquely crosses the high ridges of that section of the Tennessee Valley. This road makes a sweeping curve on the concave side of the meander of the Tennessee River at Knoxville. It runs northeastward following White Creek Valley to its headwaters and crosses the minor valleys to Corryton. The route follows Big Flat Creek to its headwaters near Clear Spring. Thence, the road is winding to a great degree. It turns abruptly northward through a water gap in Copper Ridge and in a short distance turns northwestward through a water gap in Log Mountain.. Within half a mile, it turns up the valley of Dutch Creek in a northeastward

direction winding through the ill-defined valleys of the region. It makes one wide curve to touch the town of New Tazewell. The road emerges from a maze of hills to follow a meander of the Powell and parallel Indian Creek Valley to the tunnel under Cumberland Gap, through which it passes to Middlesboro, Kentucky. (Cumberland Gap is shown on Plate 5). This route lies across long parallel outcrops of shales, sandstones and limestones. The route passes through the ridges by gaps and parallels the limestone valleys where practical. It lies across rough topography, but is located along probably the most feasible course to its objective points.

The Morristown and Ashville Division of the Southern.

The line of the Southern System between Morristown and Asheville lies across the trend of the topography. It follows a tributary of Long Creek in its winding course through the dissected Bays Mountains, and another stream valley almost to the French Broad River Valley. It follows the French Broad and Big Pigeon Rivers to Newport. Thence it cuts across the low watershed to Bridgeport and follows the canyon-like valley of the French Broad River into North Carolina. This railroad to the East follows the natural passage way through the mountains of East Tennessee into North Carolina. The stream valley is gently sloping though narrow, and offers a remarkably uniform winding grade through the mountains.

The Carolina, Clinchfield and Ohio.

The Carolina, Clinchfield and Ohio Railroad enters Tennessee along the Doe River Valley. It follows the valley northwestward to near Johnson City, and thence parallels the valley of the Watauga and Holston Rivers to Kingsport, and



Plate V. Cumberland Gap.

the North Fork of the Holston into Virginia. This railroad crosses the mountainous northeast corner of the state. It follows the valleys of the streams which provide the only practical route for a railroad.

C. Spur Railroads of East Tennessee.

There are many spur or branch railroads in East Tennessee that act as feeders for the main lines. There has been a tendency toward the withdrawal of these lines and parts of most of them. The competition of highway carriers is largely responsible for this withdrawal. Most of the spurs run into the mountains, some of them into the plateau, and a few lie within the Tennessee Valley.

Morristown and Paint Rock Division of the Southern.

The old Morristown and Paint Rock Division of the Southern System entered the state near Waterville on the North Carolina line. It followed the valley of the Pigeon River in a northerly direction to Newport. From Newport to Morristown, it ran over the tracks of Morristown and Asheville line of the Southern. The rails lay along Turkey Creek northward to the Holston River which it paralleled for about five miles before turning northwestward along the valley of German Creek. Thence the railroad followed the broad level valley southeast of Clinch Mountain to Blaine. The valley grows narrower and more rugged toward the southwest. Below Blaine the railroad turned westward past the end of Clinch Mountain to Corryton. This line lay through the rough section between Morristown and Corryton. The route was long and duplicated the service of other lines. The part of the line between Morristown and Corryton has been withdrawn. The part along the Pigeon River is still in use.

Two spur lines run southward from Damascus, Virginia, into Johnson County, Tennessee. One of these followed the valley of Beaverdam to Shady Valley Cove. The other followed Laurel Creek to below Coal Spring and several spurs ran into the smaller coves. The stream valleys offered the only practical courses into the mountains. They were built primarily to carry lumber from the mountains and are branches of the Virginia-Carolina Railroad. A spur timber line follows the valleys of Fishdam and Little Jacob Creek in Sullivan County, and probably ran northwestward to Bristol through a break in the ridges north of the South Fork of the Holston.

The Virginia and Southwestern Railroad.

The Virginia and Southwestern Railroad extends southwestward from Bristol along Beaver Creek. It passes through Bluff City and follows Indian Creek through a rough knobby section. Near Elizabethton it swings northwestward along the valley of Stony Creek to Carter. It was probably intended to extend further to the northeast to meet the railroad which reached Shady Valley Cove from Virginia. From Hunter Station a branch line continued up the Watauga River and Roane Creek to Maymead.

The South and Western Railroad.

The South and Western Railroad runs in a southerly direction from Johnson City along Buffalo and North Indian Creek valleys to below Erwin. Below Erwin the railroad follows the Nolichucky River into North Carolina.

The Johnson City and Embreville Division of the Southern.

A spur line runs southwestward from the Southern line at Johnson City to Embreville. It passes through the knobby

ridges of the section along the valley of a small stream which provides a usable route. This spur was built to bring out iron and zinc.

The L & N Between Athens and Tellico Plains.

The Louisville and Nashville operates a spur line between Tellico Plains and Athens. It runs from east to west across the trend of the ridges and valleys. The spur crosses the main line of the Louisville and Nashville at Tellico Junction and contacts the Tennessee main line of the Southern at Athens. The spur follows the valleys of two small streams through the Red Knobs and crosses several small valley ridges by way of gaps.

The Knoxville and Augusta.

The Knoxville and Augusta Railroad extended from Knoxville to Calderwood. The line followed a winding course southwards through the rolling country between Knoxville and Maryville. Thence it paralleled the northwestern front of Chilhowee Mountain to the gap cut by the Little Tennessee River. The roadway followed the river valley southeastwards to Calderwood and the line is being taken up. It was intended to continue through the mountains to Augusta, North Carolina. Failing to do so, it lacked sufficient hinterland to maintain it.

At Caryville a branch of the Southern System turns northward along the longitudinal trough adjacent to the front of the Cumberland Plateau to LaFollete. The branch parallels the Louisville and Nashville line, and follows an advantageous natural route.

The Tennessee and North Carolina Railway.

The Tennessee and North Carolina Railway extends east-

ward from Knoxville to Sevierville. Its name implies that it was intended to continue eastward into North Carolina. The railroad cuts almost directly across the rolling region between its terminal points. It swings through the more dissected northern part of Bays Mountains and the so-called slate knobs. The road is excessively winding and could easily have followed the natural route along the valleys of the French Broad and Pigeon River.

Several spurs of branch lines penetrate the part of the Cumberland Plateau in East Tennessee. The Southern System operates spurs to Pioneer, Briceville, and Brushy Mountain. Spurs from the Cincinnati-Southern enter the Plateau to Jewett, and follow the valleys of Roaring Creek and Rock Creek. Another spur from the Cincinnati-Southern extends from Oneida to the New River of Tennessee and follows its valley into Middle Tennessee. A spur line follows a stream valley from the Nashville, Chattanooga and St. Louis in the valley of Running Creek to the Aetna Mine in Raccoon Mountain. A spur ran from the Cincinnati-Southern at Rockwood to Rockwood Landing on the Tennessee River. There was a railroad about four miles in length which ran northwestward from Bacon Gap to the Tennessee River below Rockwood. The Louisville and Nashville System operates a line which passes into Tennessee at Cumberland Gap, turns northeastward into Virginia, and is a segment of a main line.

All of the spur lines found on the maps of the Unaka Mountains followed water courses closely. With one exception, that of the Cincinnati-Southern to Jewett known as the Tennessee and Sequatchie Valley Railroad, the spurs into the pla-



Plate VI. A Part of the Southern Railroad Yards
in Knoxville.

teau follow streams. The spurs in the valley follow streams throughout most of their courses across the valley.

MODERN HIGHWAY TRADE ROUTES

A. Parallel to the Ridges and Valleys.

East Tennessee is served by a network of arterial highways which are supplemented by secondary highways and county roads. Most of the more important routes extend from northeast to southwest, paralleling the ridges and the valleys. However, a number of highway trade routes reach their objective points across the trend of the ridges and valleys. The former are characterized by direct courses and gentle slopes; the latter by winding courses and steep grades. The highways generally radiate from the centers of population to the less densely populated sections. The major highways pass through the larger cities and towns along practical routes. They were constructed, with few exceptions, along short practical routes to their objective points. Distance, drainage, and grade were the deciding factors, and one was often sacrificed for the other. The older routes were more dependent upon grade. The later highways are more often built as a cross section, cutting directly across some of the knobby regions. The highway transports can climb steeper grades and turn sharper curves than the railroad trains, and consequently the highways are more flexible than the railroads. (The great highway trade routes of East Tennessee are traced on Plate 6.)

The Great Valley of East Tennessee is closely furrowed by parallel valleys and ridges which continues beyond the borders of the State in both directions. The Highways of East Tennessee are built both parallel to and across the trend of these ridges. The routes paralleling the ridges follow the same outcrop for long distances. They follow natural routes

along the valleys carved in the calcareous outcrops, or along the sides of the valley ridges. The routes along the longitudinal outcrops seldom follow the streams closely but parallel them along the valleys.

Stevenson, Alabama to Crossville.

A natural trade route lies along Sequatchie Valley. A highway enters Tennessee from Alabama and follows it throughout its entire length in Tennessee. It passes through South Pittsburg and Pikeville, and ascends the plateau southeast of Crossville. The route parallels the northwestern escarpment bordering the valley. This is about 1,000 feet above the Sequatchie River. The valley is a great trough sink lengthwise in the body of the Cumberland Plateau in a breached anticline. It is similar to the Great Valley in the origin and development of its topographic forms.

Chattanooga to Cumberland Gap or Jellico.

A great natural route runs northwestward from Chattanooga to Cumberland Gap or Jellico by way of Clinton. It parallels the Tennessee River to Rockwood and the Clinch to near Coal Creek. The highway does not follow the streams, but parallels them along the northwestern side of their general valleys. The great trough adjacent to the face of the Cumberland escarpment forms a natural passageway for human intercourse. It has a remarkably uniform slope through a section that is roughly rolling. Traffic from the far south passes through Chattanooga, Dayton, Rockwood, Harriman, Clinton, to Caryville. There the route branches. The eastern follows the longitudinal trough to Cumberland Gap. At LaFollete a branch turns northward along the Louisville and Nashville to Jellico.



Plate VII. Sharp's Gap.

The route turns northwestward along Cove Creek to Elk Gap, which it crosses and follows the valley of Elk Creek to Jellico. This Caryville-Jellico route lies along the crumpled and eroded edges of the great oblong block which is separated from the plateau proper by the eroded fault zone.

Chattanooga-Kingston.

A highway follows the southeastern side of the Tennessee River Valley from Chattanooga to Kingston by way of Georgetown and Decatur. It follows the major valley of the Tennessee River throughout its course, but as a rule is more than a mile from the river and is often separated from it by low ridges. The highway occupies one of the most uniform longitudinal troughs in the Tennessee Valley. It has several long tangents, and crosses a few ridges. These are usually low and broad. At Kingston the highway loses its definite direction and merges with other highway routes connecting it with Knoxville, Nashville, Cumberland Gap or Jellico. At the present time, the highway is of secondary importance and has just been improved throughout its length. It will become much more important in the future.

Chattanooga-Knoxville-Bristol.

The most used highway in the Tennessee Valley connects Chattanooga and Bristol by way of Knoxville. The highway follows a single route to Knoxville from Chattanooga, but branches at Knoxville to follow two courses to Bristol. The highway runs in an easterly direction from Chattanooga to Cleveland. It passes under Missionary Ridge by a tunnel and through White Oak Mountain by way of the gap occupied by Little Wolftever Creek. From Cleveland the roadway runs northeastward to

Knoxville along a general trough. It passes through Athens, Sweetwater, Loudon and Lenoir City in this part of its course. The highway parallels the Bristol and Chattanooga Division of the Southern Railway System from Knoxville to Chattanooga.

Knoxville-Bristol.

The highway branches at Knoxville and follows two routes to Bristol. The westernmost is the more direct, reaching Bristol by way of Rutledge, Rogersville, Kingsport and Blountville. It follows the longitudinal trough southeast of Clinch, Short, and Stone Mountains to near Rogersville. It crosses a bold ridge northeast of Rogersville and is in alignment with the Holston River Valley to Kingsport. It passes over a high ridge east of Kingsport and parallels the valley of the South Fork of the Holston for several miles before swinging northeastward through Blountville to Bristol. The route lies along the well-defined valleys of small streams for most of the distance from the South Fork of the Holston to Bristol.

The easternmost of the two routes between Knoxville and Bristol passes through Jefferson City, Morristown, Greeneville, Jonesboro, and Johnson City. It is in close alignment to the Southern Railway connecting Knoxville and Bristol. The highway follows the broad valley of the Holston River from Knoxville to near Whitesburg, a distance of more than fifty miles. Near Whitesburg the road swings southeastward through Bays Mountains to Greeneville. Thence it runs northeastward to Johnson City threading its way through the knobby ridges of the section. It continues in a more northerly direction to Bristol by way of Bluff City, following the valleys of

minor streams through the knobby region.

Conasauga-Bristol.

A longitudinal trough parallels the Unaka Mountains through the State of Tennessee. In the southern half of East Tennessee, the trough is broad and well-defined; in the north it is much broken. A highway enters from Georgia and follows this general trough through Benton, Madisonville, Maryville, Sevierville and Newport to Greeneville where it joins the eastern Knoxville-Bristol Highway. This route may be followed from Maryville through Knoxville to Sevierville. The gradients south of Maryville are more gentle and uniform than the Maryville-Bristol section, and the tangents are longer. The ridges are well-defined along the southern part of this route, but in the northeast they are short and incoherent, and the highway threads its way through the gaps, and around the knobs.

B. Highways across the Trend of the Topography.

A number of highways in East Tennessee connect points which must be reached across the trend of the topography. These cross the long parallel outcrops of the folded and faulted valley strata. Each outcrop of different rock has resistance to erosion. The less resistant strata form valleys, the intermediate form low ridges, and the more resistant form high ridges. The parallel valleys and ridges are often continuous for great distances, but at places are broken or dissected. The highways pass through the gaps formed in the ridges by running water, and usually parallel the valleys to reach the gaps. They are more flexible than the railroads, yet they adjust themselves to the topography in a like manner.

Chattanooga-Jasper.

Two highway routes connect Nashville and Chattanooga. The southernmost runs southwest from Chattanooga past the northern end of Lookout Mountain, and swings westward across Walden Ridge and partly across Sequatchie Valley to Jasper. From Jasper it runs northwestward to Nashville by way of Manchester.

Chattanooga-Wauhatchie.

The northernmost Nashville-Chattanooga highway runs northwestward from Chattanooga over Walden Ridge to Whitwell in Sequatchie Valley. It follows the valley of the Tennessee River for about eight miles northwestward from Chattanooga. The route follows Suck Creek Valley to near the western escarpment of Walden Ridge, passes through a gap and descends to Sequatchie Valley along a stream valley. It then crosses the Sequatchie Valley to Whitwell. The highway ascends the Plateau proper west of Whitwell and follows a flat divide to Tracy City.

Ducktown-Pikeville.

A highway enters Polk County from Blue Ridge, Georgia. It passes through the Ducktown Basin and runs northwestward to Etowah. This segment of the road is known as the Kimsey Highway. It ascends the Frog Mountains and winds along for several miles near the crest. A more southern route along Parksville Lake and the Ocoee River has been constructed recently to supplement this highway. From Etowah the route passes through Athens, Decatur, Dayton, and Pikeville into Middle Tennessee. The road is winding throughout most of its course and crosses the great number of ridges which are found in this part of the

valley. Some of these exceed 400 feet in height, and there are many steep grades. This route is of local importance.

Topton-Loudon.

A route with great scenic attraction enters East Tennessee from Topton, North Carolina, by way of Santeetlah, Cheoh and Calderwood lakes. It winds its way through the mountains into Tennessee, and follows the valley of the Little Tennessee River to Loudon. Throughout its course in Tennessee it is in alignment with this mountain stream. In the mountainous part of its course it is very crooked, and is a poor route for large motor transports.

New Found Gap, Maryville, Knoxville, Cumberland Gap.

Another route from North Carolina enters Tennessee through New Found Gap in the Great Smoky Mountain National Park. Although taking advantage of a deep gap, it crosses the rather high and steep divide between the basins of the Little Pigeon and Little Rivers between Gatlinburg and Elkmont. The grade here is very steep, and is an exceedingly difficult climb for large freight trucks. It is in general alignment with Little River to Maryville and closely parallels the stream through most of its course in the Unaka Mountains. The slope of the valley is gentle. From Maryville, the highway runs northward across a rolling section to Knoxville. It may be considered as extending northward through Knoxville to Cumberland Gap. This part of the route lies obliquely across the ridge and valley topography of the Tennessee Valley. It crosses five prominent ridges and several smaller ridges in the twenty-four miles between Knoxville and Maynardsville. The route approximately parallels the northeast-southwest

trend of the topography between Maynardsville and Tazewell, crossing only two ridges of any formidable size. The road follows or is in alignment with the valleys of small streams through the knobby region between the Powell River and Cumberland Gap, the gateway to the North Central States.

New Found Gap, Sevierville, Knoxville, Jellico.

About two miles south of Gatlinburg a route branches northward from the above highway. It runs through Gatlinburg and Sevierville to Knoxville, extending on to the northwest through Clinton to Jellico. It follows the West Fork of the Little Pigeon River from its headwaters south of Gatlinburg to Sevierville. The grade is uniformly gentle. Between Sevierville and Knoxville the road winds through the so-called slate knobs, dissected Bays Mountains, and the rolling dolomitic section southeast of Knoxville. The highway cuts directly across part of the rolling country. Between Knoxville and Clinton, the highway passes through several prominent and many smaller ridges. It takes advantage of water and wind gaps in passing the higher ridges and is winding in its course. Between Clinton and Coal Creek it follows Brushy Creek Valley for several miles. Between Coal Creek and Jellico, it is a part of the route from Chattanooga to Jellico. It follows the natural highway route along the northwestward trending part of the Cumberland Escarpment and follows Cove and Elk Creek Valleys to Jellico. It passes over the divide between the two streams through the gap of Elk Fork.

Ashville, Knoxville, Nashville.

The greatest highway across East Tennessee from east to west is the Asheville, Knoxville, and Nashville route. The

highway parallels the deep valley of the French Broad River into Tennessee. It crosses the divide between Bridgeport and Newport on the Pigeon River, and follows the valleys of Sinking and Schom Creeks through the roughly rolling country to the valley of the French Broad River. It partly follows and partly truncates the meanders of the stream until it leaves the River Valley to follow the broad uniform trough southeast of Bays Mountain. It is in alignment with the French Broad and Tennessee Rivers from Strawberry Plains to Knoxville. The highway follows a southwestward course from Knoxville to Eaton's Cross Roads. There it turns westward to Nashville by way of Kingston and Rockwood. It crosses Dug, Chestnut, Black Oak, and several smaller ridges before reaching Kingston. The highway ascends the Plateau south of the deep-cut valley of Fall Creek. It continues to Nashville, passing through Crab Orchard Mountains by way of Crab Orchard Gap. This highway passes entirely across the three physiographic divisions of East Tennessee. Through the Unaka Mountains, it follows the French Broad River Valley. In crossing the Tennessee the Tennessee Valley, it occasionally paralleled the ridges, and as a rule crosses them at their lower points. It ascends the Plateau up a stream valley and passes through Crab Orchard mountains by way of Crab Orchard Gap. The route is relatively short and direct, but it has some steep grades, and is winding in part of its course. It is probably the most used east-west road across the Tennessee Valley.

Newport, Tazewell, Cumberland Gap.

At Newport a route branches northwestward from the

great Asheville, North Carolina, to Nashville, Tennessee, route. It runs to Cumberland Gap by way of Morristown and Tazewell, and onward through Cumberland Gap to Middlesboro, Kentucky. From Tazewell to Cumberland Gap, it is a part of the Maryville, Knoxville, Cumberland Gap Route. The route lies along the valley of the Pigeon and French Broad Rivers in their northerly course from Newport to Leadville. The highway winds through knobby Bays Mountains and the rolling country south of Morristown. It follows the valleys of Turkey and German Creeks from Morristown to Bean. From Newport to Bean, the road is in close alignment to the old Paint Rock and Morristown division of the Southern Railroad. It runs northwestward from Beans to Tazewell across some of the highest valley ridges. The road winds over Clinch Mountain by way of Bean Gap. Thence it passes through gaps in Copper, War, Caney, and Comby Ridges, and around the butt of Powell Mountain to Tazewell. The gradients are difficult and the road winding. This route will never serve any great amount of through motor traffic.

Asheville, Greeneville, Rogersville, Jonesville.

The route from Asheville, North Carolina, to Jonesville, Virginia, enters Tennessee from North Carolina near the village of Deep Gap in the Unaka Mountains. It follows the valley of a small creek through the mountains and runs in a northerly direction to Greeneville. This part of the highway has many sharp turns and steep grades. From Greeneville the road runs across the wide valley of Lick Creek and winds through the Bays Mountain Group of high ridges to Rogersville along Crockett Creek Valley in a northeastward

direction, but swings northward to Jonesville, crossing Stone and Clinch Mountains through wide gaps. It follows War Gap Creek through a number of ridges northwest of the village of War Gap, and Black Water Creek Valley into Virginia. The route reached its objective points across the trend of the topography, and its course is winding and difficult. The gaps make a usable route possible.

Asheville, North Carolina, Erwin, Kingsport, Gate City, Virginia.

A northwestward trending highway crosses East Tennessee from Asheville, North Carolina, to Gate City, Virginia, passing through Erwin, Jonesboro and Kingsport in East Tennessee. The Nolichucky River Valley provides a natural route with a relatively gentle slope from North Carolina through Erwin to near Garbers. The highway threads its way northwest across a rolling section through Jonesboro to Fall Branch. There it swings northward along Horse Creek Valley to the Holston River Valley, which it follows to Kingsport in a northwest direction. The highway follows the natural route to the north along the valley of the North Fork of the Holston River. In Virginia it passes through Big Moccasin Gap in Clinch Mountain and continues northward. This route is adjusted in a practical way to the stream valleys in its course across the topography. A great part of the highway is characterized by relatively smooth gradients.

Cranberry, Elizabethton, Bristol.

A highway enters Tennessee from North Carolina along the Doe River Valley, which it follows through Hampton to Elizabethton. It runs northward from Elizabethton through Bluff City to Bristol, following the valleys of Indian,

Whitetop and smaller creeks. The route takes advantage of the river valleys in the mountainous region. It is winding throughout most of its course, but has uniform gradients along the valleys.

Boone, North Carolina, Mountain City,
Damascus, Virginia, or Bristol.

The route from Boone, North Carolina, to Bristol enters Tennessee along Roans Creek Valley, which it closely follows to Rhea Forge. It follows Town Creek Valley to Mountain City, where it branches. The eastern route follows Laurel Branch Valley to Damascus, Virginia. The gradients are steep but relatively uniform. The western branch turns northwestward to Bristol. It crosses Iron and Holston Mountain, and passes Shady Valley Cove. The route follows the valley of a small stream to the Holston River which it crosses near the village of Holston Valley. It turns southwestward through a water gap in a group of high parallel ridges, and runs northwestward to Bristol. The route has some of the steepest highway grades in East Tennessee and is exceedingly winding. Its importance as a trade route is local, for it is^a difficult route for large motor trucks.

THE INFLUENCE OF PHYSIOGRAPHY ON TRADE ROUTES IN EAST TENNESSEE

The buffalo trails in East Tennessee follow probably the best natural routes in the region. The buffalo merely migrated from feeding ground to feeding ground or salt lick. He had no need for high speed and no civilization to serve. The roads worn by the buffalo paralleled the valleys wherever possible, they crossed the rivers on the bars at the mouths of tributary streams, and they passed every high ridge by way of gaps. Guided by instinct, the buffalo found excellent natural routes.

The mound building Indian and the later Indian followed trails that were in general alignment with the roads of the buffalo. The Indians carried on a limited commerce and their trails were principally war and hunting paths. The economic structure of the aborigines of America did not demand rapid transportation. They sought routes that were characterized by gentle gradients and often followed the buffalo paths. The buffalo and the Indian followed running water in the parts of the trails within the mountainous sections. They passed the high ridges through gaps, and paralleled ridge and valley topography wherever practical. The trails often lay upon the high ground and avoided unnecessary crossing of the major streams.

The white pioneers, hunters and traders came into East Tennessee over the Indian trails which in turn closely followed the buffalo roads. The "Wilderness Road" built by Daniel Boone was merely a widened and blazed Indian thoroughfare. The traders carried the peltry bought from the Indians to

the seaboard towns along the Indian trails. The white settlers had little time for the routing and building of roads, so they made use of the trails they found. There is little difference between the routes followed by the buffalo, the Indian, and the white man in their adjustment to topographic forms. They were often coincident, especially in the mountains, the plateau, and in crossing the high ridges.

The trade routes of the present day are restricted to a noticeable extent in their adjustment to topography. East Tennessee was settled along its rivers. The older settlements are clustered about the upper Tennessee Valley and the country developed downstream. The rivers were the carriers of the products on the territory and the economic structure grew up on this basis. Waterways were superseded by railway and highway transport. These were drawn slightly out of alignment with the natural forms in their attempt to serve the towns that had grown up along the rivers. The modern trade routes are often influenced in their detailed location by political pressure or esthetic considerations. The rapid transportation of goods and people is a foundation of the modern highly specialized industry. Speed is one of the first requirements of a modern carrier and the more modern routes were built with this in view. However, they are often in general alignment with the trails followed by the buffalo and Indian. Deep cuts and fillw have modified the grades and eliminated a great part of the curves. The more modern highways show a tendency to take a cross section rather than follow the contour of the surface. The roads which follow the courses marked out in the early days were located to meet

the demands of animal drawn traffic. Curves were not a source of great danger. These roads followed the contour of the surface to find the gentler grades.

As a whole the modern trade routes of East Tennessee are admirably adjusted to topography. They make an excellent showing if the towns they contact are taken more or less as terminal points and the roads and railroads considered in sections. They were often forced to reach their objective points across the trend of Southern Appalachian topography. The routes across the ridges are expensive to construct and maintain. They are characterized by steep grades and winding courses. Yet a close study of large scale maps shows that these routes were admirably located. With no known exception every prominent ridge crossed by a trunk highway or railroad is passed by way of a gap. The rail and highway routes that follow the trend of the ridges and valleys follow natural courses. They cross few ridges, and often lie along one general trough for a great distance. The gentle gradients of the stream valleys offer the best routes for heavy traffic in the territory.

The Effect of the Unaka Mountains

The high crest line of the Unaka Mountains forms, for the most part, the boundary between Tennessee and North Carolina. It rises to altitudes of from 4,000 to 6,650 feet above sea level. The western slope of the Unakas and the foothills form the most rugged surface in the eastern part of the United States. The effect of these mountain ranges has been and must always be to separate the people on either side. They form a great barrier which is broken only by the gorge like

valleys of the streams which have maintained their northwestward courses through the mountains. The antecedent rivers are influenced only locally by geologic structure. Their valleys extend in a general northwestward direction and form the natural routes through the mountains. Every railroad in the mountains of East Tennessee follows a stream Valley. The Southern Railroad line between Knoxville and Asheville follows the French Broad Valley in its course through the mountains; the Carolina, Clinchfield, and Ohio follows the Doe River; the Louisville and Nashville parallels the Hiwassee and its tributary streams; and every spur line into the mountains is in close alignment with a stream. The cuts are often deep and rocky, and the ranges abut closely upon the valley, but the river gorges are the only avenues for railroad communication through the mountains of East Tennessee. The highways through the mountains are not as closely associated with running water as the railroads. They are often influenced by esthetic considerations. The majority of the mountain highways are of local importance as trade routes. The expense of hauling goods through the mountains to North Carolina is often prohibitive and East Tennessee is bound more closely to eastern Pennsylvania and New York or Georgia and Alabama than to North Carolina.

The Effect of the Topography of the Tennessee Valley upon Trade Routes.

The Appalachian Valley is a great trough extending southwestward from southern New York to central Alabama. It is bounded on the east or southeast by the Appalachian Mountains and on the west or northwest by the Appalachian Plateau. This trough has been called the Great Valley, and its con-

tinuity has marked it as a great highway. The Great Valley of East Tennessee is a segment of this great natural trade route. The majority of the railroads and highways of East Tennessee parallel the valleys and ridges which closely furrow the floor of the Tennessee Valley. The ridges and valleys trend toward the northeast. The detailed courses of the railroads and highways depend upon the minor details of the topography and the points to be contacted in its course. The incoherent ridges and valleys in the northeastern and other parts of the Tennessee Valley are difficult terrain for railroads and highways. They are obstacles to travel in and direction. The courses through the knobby regions are often winding and characterized by many cuts and fills. The valleys of the streams traversing these sections are the best natural routes. The long parallel and well-defined ridges mark out long valleys which are followed by railroads and highways for great distances. The valleys are significant of gentle profiles from northeast to southwest. They are usually drained by a number of streams which have eroded their valleys along the outcrops of the calcareous rocks. The divides between the streams of a trough are ordinarily low and indistinct. If the objectives of the highway or railroad must be reached across the trend of the ridges and valleys, the gaps cut through the ridges by running water assume primary importance. The streams which formerly flowed northwestward across the Tennessee Valley and the Cumberland Plateau were diverted to the southwest by the Tennessee River and its southwestward flowing tributaries. Their old courses were brought into relief by differential erosion along the longitudinal outcrops, and are marked by a succession of gaps in the ridges.

Part of the gaps are still occupied by running water. The trade routes across the high and otherwise continuous ridges take advantage of these gaps in almost every case. Many of the higher ridges such as Clinch, Newman, and Powell Mountains are not crossed by railroads in East Tennessee. No railroad entirely crosses the Tennessee Valley across the trend of the topography. Highways make the crossing in several places, but only one of these, the Asheville-Knoxville-Nashville route is a trade route of more than local importance. This route follows the trend of the topography for miles in parts of its course, and connects great centers of population.

The Cumberland Plateau is a Great Barrier to Trade.

The Cumberland Plateau is a part of the Appalachian Plateau which extends southwestward from southern New York to central Alabama. Its escarpment rises steeply and abruptly above the Tennessee Valley. It has an average height of about 1,000 feet throughout Tennessee. Cumberland Gap near the intersection of the Tennessee, Virginia, and Kentucky lines is a great break in the front of the Cumberland Plateau. The gap is a strategic point and is the gateway between East Tennessee and the north central states. Two railroads use the same tunnel through the gap, and a highway passes over them. Elk Fork Gap is the next great break in the continuity of the plateau. Cove and Elk Creeks have eroded deep valleys along fault zones in the plateau and Elk Fork Gap is the divide between them. A railroad and a highway follow this natural route to Jellico from Coal Creek. Emory River occupies a gap formed by a former northwestward flowing stream. The Cincinnati-Southern Railroad and a highway follow the river valley

into the plateau. The Tennessee River cuts entirely across Walden Ridge in a deep and narrow canyon. The rough gorge, sometimes called the Grand Canyon of the Tennessee, does not make a practical route for trade highway or railroad. The cut is steep and rocky, and the course exceedingly winding. The arm of the plateau below the gorge, Raccoon Mountain, is almost cut through by Running Creek. A tributary of Lookout Creek has eroded a valley into the plateau from the East. The two streams valleys are separated by a low divide, and form the only practical route through the front of the plateau in the section. A highway and the Nashville, Chattanooga, and St. Louis Railroad pass through the valley. The effect of the Cumberland Plateau has been to distinctly separate that part of the State lying east or southeast of the Cumberland Escarpment from the remainder of the State. It must be considered as a great barrier.

The location of the trade routes of East Tennessee has been profoundly influenced by the parallelism of topographic forms. The Unaka Mountains on the East or southeast must be considered as a great barrier. The Cumberland Escarpment is a great wall on the west or northwest. The Great Valley of East Tennessee, the trough between the two, is closely furrowed by ridges parallel among themselves and to the great natural highway from northeast to southwest. Across the trend of its topography it offers poor routes. The trade routes in the Tennessee Valley exhibit a marked parallelism. With few exceptions, every important through trade route extends from north or northeast to south or southwest. No railroad runs from east to west entirely

across the Great Valley of East Tennessee, although several oblique across a portion of the valley. One important highway trade route extends entirely across East Tennessee from east to west. It connects large cities and parallels the ridges in part of its course in the Tennessee Valley. Several less important highways parallel this great road across East Tennessee or parts of the Great Valley. They, with the longitudinal routes, make a great network which divides East Tennessee into roughly rectangular sections. The buffalo, Indian and white man found the same courses through the section. The modern highway and railroads are often built adjacent to each other. They are drawn slightly out of alignment with the natural courses by the necessity of contacting centers of population which have grown up off of the natural route. However, their courses are ordinarily along running water, especially in the mountainous sections. The streams have eroded their valleys in the longitudinal outcrops of the calcareous rocks or maintained their courses as the mountains and ridges were formed across their beds. Their valleys form the natural routes over which human intercourse moves.

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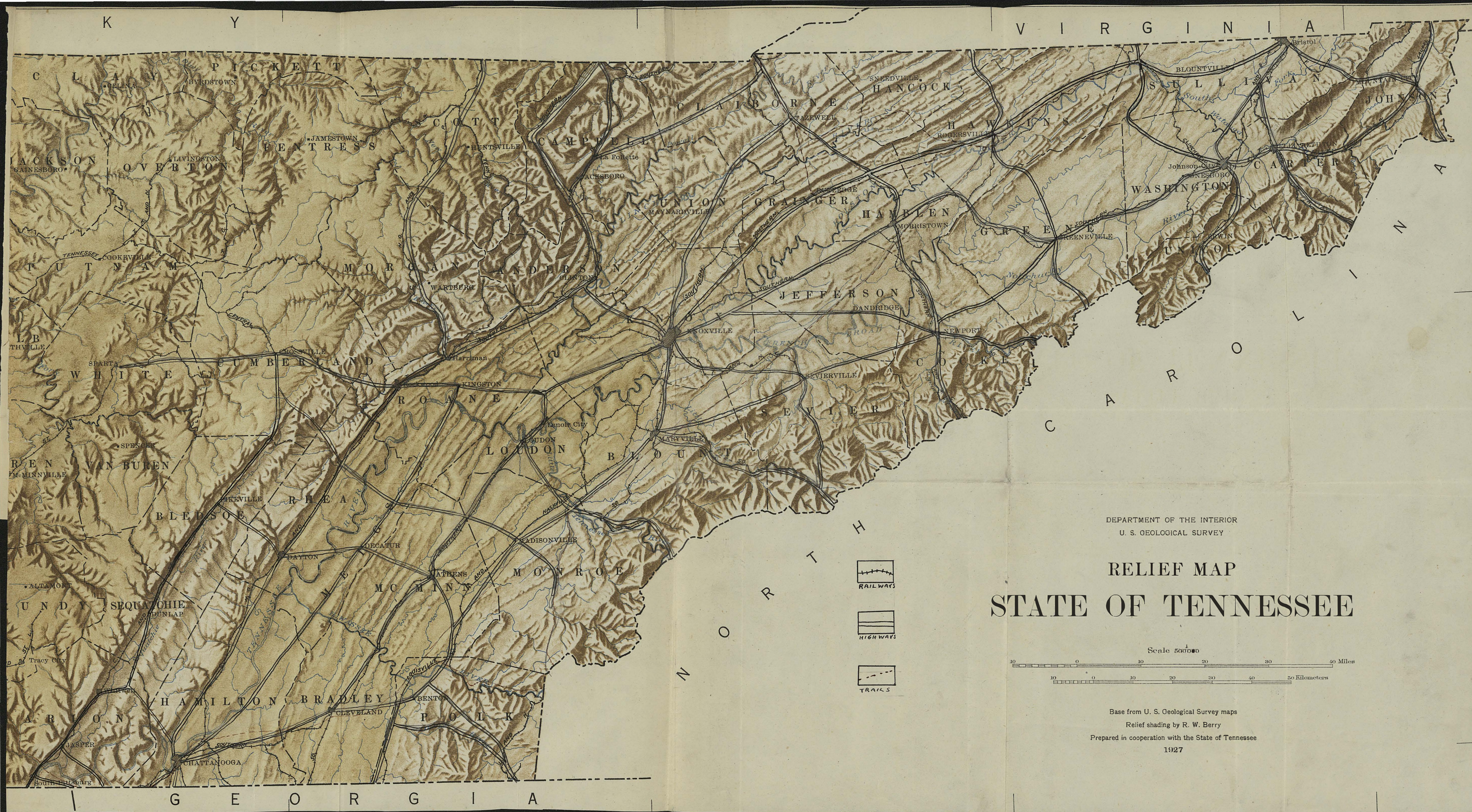
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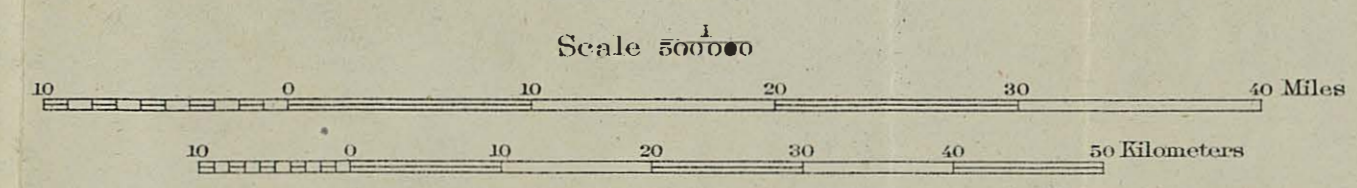
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DEPARTMENT OF THE INTERIOR
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RELIEF MAP STATE OF TENNESSEE



Base from U. S. Geological Survey maps
Relief shading by R. W. Berry
Prepared in cooperation with the State of Tennessee
1927