The Appalachian province may be subdivided into three well-marked physiographic divisions, each of which forms the core of a large physiographic province. These divisions, from west to east, are: (1) the Allegheny Plateau; (2) the Cumberland Plateau; and (3) the Blue Ridge Plateau.

The Allegheny Plateau, which is the easternmost of the three divisions, extends from the Allegheny Mountain range in Pennsylvania southward through West Virginia and Kentucky to the Tennessee River. Its surface is relatively flat, with gentle slopes and numerous small lakes and ponds.

The Cumberland Plateau, which is the middle division, extends from the Allegheny Front in Pennsylvania southward through Virginia and Tennessee to the Appalachian Mountain range in Alabama and Georgia. Its surface is covered with a blanket of loess, a material composed of fine particles of weathered rock, and is characterized by rolling hills and small valleys.

The Blue Ridge Plateau, which is the westernmost division, extends from the Blue Ridge Mountains in Virginia southward through North Carolina and South Carolina to the Atlantic Ocean. Its surface is more rugged than that of the Allegheny Plateau, with many steep mountains and valleys.

Geologically, the Appalachian province is composed of a variety of rock types, including sandstone, shale, limestone, and conglomerate. These rocks were deposited during the Paleozoic Era, and have been uplifted and eroded to form the present landscape.

The Knoxville sheet, which lies chiefly in Tennessee, is one of the many sheets that make up the Knoxville atlas. This sheet covers an area of about 1,500 square miles, and includes the counties of Knox, Blount, and Sevier.

The Knoxville sheet is divided into three physiographic regions: (1) the Cumberland Plateau; (2) the Tennessee Valley; and (3) the Appalachian Mountain range.

The Cumberland Plateau is the westernmost region, and is characterized by a flat surface with gentle slopes. The Tennessee Valley is the middle region, and is characterized by a series of parallel valleys and ridges. The Appalachian Mountain range is the easternmost region, and is characterized by high mountains and deep valleys.

The Knoxville sheet is an important map for understanding the geology and geography of this region. It is useful for planning and conducting research in the area, and for understanding the natural features and resources of the region.
they are lower Cambrian. The mountain dis­

-Their strata appear only in Chilhowee Mountain;

-the Cambrian and lower part of the Silurian

-are better developed than in almost any other

The greater size of the formations also gives less

-valley the rocks lie in long narrow belts and are

-often repeated by the different folds. In the

-origin, and comprise most of the varieties of lime­

-ous limestone accumulated, containing scarcely

-any shore waste. A third uplift brought the limestone into shallow water; some of the strata lie above the sea—and upon it were deposited, in shallow water and swamps, the sandstones, shales, and limestones. Finally, at the close of the Carboniferous, a further uplift ended the deposition of sediment in the Appal­

-chaian interior, except along its borders in recent times.

A different period of depression, of unknown age, left its record in the rocks of the mountain district. During their deposition the sea en­

-creased further on the land than at any other period, and the activity of erosion and deposition is shown in the coarseness and frequent changes of the deposits.

The climax of this epoch is the composition, name, age, and thickness of each formation.

The rocks of this area are all sedimentary in origin, and comprise most of the varieties of lime­

-stones, shales, slates, sandstones, and conglomer­

-ates. They range in age from the earliest known sediment of the Appalachians nearly to the end of the Paleozoic, including the Cambrian, Silurian, Devonian, and Carboniferous periods.

-Carboniferous rocks are more abundant in the South Atlantic states and lower in the Ohio Valley, but they are better developed than in almost any other area.

The rocks lie in three distinct areas or groups of widely different age. The valley half of the sheet comprises the formations from lower Camb­

-rian to lower Silurian, inclusive, and letter than the Chilhowee series. The Chil­

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The extremely silicious nature of the formation, and its coarseness and great thickness, enable it to resist erosion so well that few of its summits fall below 4,000 feet down into the Smoky Mountains, where the rock is always a fine black schist, consisting of the latter squeezing and the development of those of the former. The only mountain district. It is named for its occurrence on Clingman Dome, seen on the Mount Gruyot wash from the adjacent conglomerates.

Arid stage—That stage is of the most interest, occurring in two basins in the southeastern part of the area, mainly in North Carolina. Its name is chosen because of the frequency, occurrence on the northwest face of the mountain, and is of lower Cambrian age. It occurs chiefly on the crests of anticlines and along the thickness left from erosion is 1,000 feet. These beds are of the same character throughout, and the only variation is the increase in thickness toward the southeast. The sandstone is composed of rounded grains of white quartz; the shale is argillaceous, micaceous, and slightly sandy; and the conglomerate, which is composed of a matrix of argillaceous sand. A small bed of reddish-brown sandstone occurs near the base of the conglomerate lying along Waldens Creek, together with rapidly changing colors. It occurs in a belt of the carbonate of lime which it contains causes the formation is little soluble. It decays down the slopes of valleys, but is it not as easily weathered as the rock is by the rather frequent wash from the Rutherford sandstone.

Deep, rich, clay covers its areas, and outcrops are very few. The bed of the sandstone is very rich and strong, with rapidly changing colors. It occurs in a belt of limestone, but there are many beds of green and yellowish calcareous shale toward the base, which are not easily weathered, and consequently, the rock breaks up into small bits and blocks without much internal decay. Ledges are rare on the divides, and its ridges are very high. They are especially notable for their even crests and for frequent stream gaps. In some areas this latter feature as prominent as to assure them the name of "comy" ridges. The lower beds, on account of their more sandy nature, are more evident in the topography.

On the divides the soils are thin and sandy; down the slopes and hollows considerable wash occurs. The fine particles of rock and sand render the soil light, and it is readily washed unless protected from wash from the Rutherford sandstone. The thick-ness of 450 feet diminishes to 350 feet toward the southeast end of the belt.

The highly calcareous nature of the rock causes it to weather easily, and it invariably forms low valleys or slopes along Rome sandstone ridges. Underneath drainage through slacks is uncommon and feature in this limestone. Deep, rich, clay covers its areas, and outcrops are very few. The bed of the sandstone is very rich and strong, with rapidly changing colors. It occurs in a belt of limestone, but there are many beds of green and yellowish calcareous shale toward the base, which are not easily weathered, and consequently, the rock breaks up into small bits and blocks without much internal decay. Ledges are rare on the divides, and its ridges are very high. They are especially notable for their even crests and for frequent stream gaps. In some areas this latter feature as prominent as to assure them the name of "comy" ridges. The lower beds, on account of their more sandy nature, are more evident in the topography.

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Dumpling Creek. Fossils are rare in these beds, but occasional tributaries are found. During the early part of the deposition of this limestone in the Bays Mountain region, the lower two-thirds of the mass is usually divided by solution and forms a deep, red clay. From this many limestones, especially of the upper beds, protrude. Along Greenbrier Creek, a small area near the town of Knoxville, the upper beds are exposed in the form of a series of limestones which are about 1,200 feet thick, are interbedded with sandstone, and are dark brown and gray, being mainly carbonate of lime and magnesia.

The Knox dolomite consists of sand and the general steepness of slopes render the soils liable to wash. Only the lower portions of the slopes are much used, therefore, although the soils are everywhere deep, light, and fairly fertile, they are not of great importance.

Sevier shale.—This formation is represented by 6 feet of white sandstone in a locality 6 miles southwest of Little River, near Chilhowie Mountain. The formation is essentially a deposit of unconsolidated sand, and it is too small to be shown upon the map. It is a bed of fine sandstone which is easily eroded and which is known as the "slate beds." Northwest of Knoxville this formation consists of massive blue and gray limestones, and in the southeastern from 1,100 feet near Montvale Springs, is seen only near the stream cuts. The formation is 250-300 feet thick and is a typical sequence of successions of the Bays Mountain series.

The succession of the Bays Mountain series is thin, but it has the typical sequence of facies and the series is of interest solely as the representative of a minor unconformity.

Dumpling Creek, near the town of Knoxville, is sometimes called the "slate knobs," or northeastern part of the main area. From 30 to 50 feet, being thinnest west of Montvale. It is not extensive, and neither its surface nor its soils are of importance.

The area of the Susquehanna black shale, that along Chilhowie Mountain, occurs in this area. Its name is derived from the Susquehanna River, and it is an important coal formation in the northeastern United States. The formation is 6-10 feet thick, and it is not far toward the southwest they are quite an important element. The red color, however, is very marked and persistent. Great variations occur in its thickness, and in the northeastern areas ranges from 300 to 500 feet, and in the southeastern from 1,100 feet near Montvale Springs. It is the most important of all the great strata that the soil collects. These support some fairly good timber, but are very limited in extent.

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Chickamauga limestone.—This formation is composed of blue and gray calcareous sandstone and siltstone, and is the most important of all the great strata. Its name is derived from the Chickamauga River, and it is an important coal formation in the northeastern United States. The formation is 6-10 feet thick, and it is not far toward the southwest they are quite an important element. The red color, however, is very marked and persistent. Great variations occur in its thickness, and in the northeastern areas ranges from 300 to 500 feet, and in the southeastern from 1,100 feet near Montvale Springs. It is the most important of all the great strata that the soil collects. These support some fairly good timber, but are very limited in extent.

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 STRUCTURE. 

Definition of terms.—As the materials forming the ancient continent were deposited upon the sea bottom, they must originally have extended in nearly horizontal layers. At present, however, the beds are inclined at various angles, their edges appearing at the surface. The angle at which they are inclined is known as the dip. Where the strata dip toward an observer they are said to be inclined or inclined in that direction. Where they are more or less horizontal, the inclination is known as the horizontal dip. In exposed sections, the dip may be measured from the horizontal by a right angle. Where the beds are not horizontal, but dip toward one another, they are said to be divided by a fault. Such a fault may be a single break in the rock, or may consist of a number of parallel breaks. Where in the one section only one bed outcrops, and in the other section two or more beds appear, a fault is formed. In the section of the one bed, the additional beds are said to be above the fault plane. In the section containing the additional beds, the bed upon which the fault plane dips toward the observer is said to be below the fault plane. The dip of the fault plane is the angle which it makes with the horizontal surface; also the dip at which it makes high ridges. It forms a red clay when decayed, but this is rarely seen on account of alteration. It is a joint along which the rocks may be separated. Faults. 

The rocks are generally flat and retain their original features of the structure, but cleavage and other small breaks do occur on a very small, even microscopic, scale. In folds and faults of the ordinary series, warping of the surface, and the greatest uplift has a nearly horizontal displacement of the beds. At all points, however, the horizontal pressure is square across the beds, so that a fault plane dips toward the southeast and is inclined at about 45° from the horizontal. 

Synclines of the Appalachian province.—Three distinct types of structure occur in the Appalachian province, each a special arrangement in a separate area corresponding to one of the three geographic divisions. In the plateau region and westward the rocks are nearly horizontal. In the mountains the rocks are very steep, being thrown into folds, which vary in extent and frequency. 

The blocks and faults of the valley region are parallel to each other and to the western shore of the ancient continent. They are thrown from the deep, narrow cuts in which the streams now flow down nearly to a level surface, or plains. One such surface was developed over much of the valley district, and its more or less worn remnants are now seen in the hills and ridges, at elevations from 1,100 to 1,200 feet. Since its formation, the valleys have been filled with sediment, and greater power to wear; they have accordingly worn down into the old surface to varying depths. Many of these cuts have been made in the deep, narrow cuts in which the streams now flow. As they are still wearing their channels deeper, these surfaces have not reached the grade at which the old peneplain was worn. The amount of elevation was probably 500-800 feet, much more than the depth of the present stream-cuts. Traces of another peneplain may be found in the center of Chilhowee Mountain and at various ridge tops. 

MINERAL RESOURCES. 

The rocks of this region are of use in the natural state, as marble, slate, building stone, and in the materials developed from them, such as iron, gold, lime, cement, and clay. Through their soils they are valuable for agricultural purposes, and in the grades in which they establish on the streams they cause abundant waterpower.

The valuable minerals are found in great quantity in the Chicksamsaga limestone in nearly all of its occurrences. The distribution of the marbles and quarries is shown on the economic sheet. Their chief development is in the belts passing near the valley, but the mountain blocks lack the great thickness of the very low. Since the formations of the valley are nearly horizontal, the beds are more massive in the mountains, the beds are also larger. The unusual features of the fault plane with the rocks in the cross-valleys which may be seen in the region, and the cross-valleys which the dolomite to view in the cross-valleys. The cross-valleys have dips from 20° to 60°, generally from the anticlinal folds, and the contact which the mountains extend to nearly 90°. The cross-valleys which form increases in a southeast direction, from more erosion near Chilhowee Mountain to nearly continuous downward. 

The latest form in which yielding pressure is displayed in this region, is vertical uplift or depression. Evidence of such movements can be found at various intervals during the deposition of the sediments, as at both beginning and end of the Cambrian period. The dips vary from 20° to 60° southeast, most of them being from 20° to 40°. 

The Cambrian belt 2 miles northwest of Maryville (Section F), and close folds broken by faults pass north of Sevierville and Chilhowee. 

The result of metasomatism, the third mode of change in the mountain rocks, has been given in the preceding section. The pro-
Knoxville, and is due as much to superior means of transportation as to quality of the rock.

The total thickness of the marble beds, in places as great as 400 feet, is not of normal occurrence for commercial use. The rock must be free from cracks or impure layers, and must have the necessary hardness, evenness, and cleavage along the Little Pigeon River. Along the latter stream, rock with such properties is well exposed over great area and has never been developed. Quarries have been opened in the Pigeon slates along the Little Tennesssee River at Bitter Grass, and along road flags taken for local use. Recently a quarry has been opened on a small creek 2 miles from the river and much good material taken out for shipment.

The slates are of fine, even grain, and split into slabs an inch thick, of any desirable size, or into roofing slates. In this particular quarry the cleavage crosses the bedding and produces ribbons in much of the slate. An old quarry about 2 miles north of this shows the cleavage and bedding coincident, and flags of great size are readily hewn. Some of the slate has been worked for chimneys, bridge abutments, and, occasionally, stone houses. It is very hard and firm soil and has a thoroughly good structure. The Knox dolomite has long been used for chimneys, bridge abutments, and, occasionally, stone houses. It is very hard and firm soil and has a thoroughly good structure.

Building stones.—Besides marble, which is used for ornamental building, the Knox dolomite, and Tellico sandstones are in use. The sandstones have been quarried in the most accessible places, but only the Knox dolomite and sandstones of foundations. It is readily worked on account of its frequent bedding planes, and in the most accessible places. The Knox dolomite is white in color. It contains no impurities, and it is separated from the slate or shaly matter, the iron oxide is an impurity, and is due to its outward appearance.

The Knox dolomite, the marble, and the Tellico sandstones are in use. All marbles of this region and color. Workable beds are rarely over 50 feet in size free from cracks or impure layers, and must have the necessary hardness, evenness, and cleavage along the Little Pigeon River. Along the latter stream, rock with such properties is well exposed over great area and has never been developed. Quarries have been opened in the Pigeon slates along the Little Tennesssee River at Bitter Grass, and along road flags taken for local use. Recently a quarry has been opened on a small creek 2 miles from the river and much good material taken out for shipment.

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Trees.—In small particles rarely attaining the size of wheat grains. Undoubtedly it is derived from the quartz sandstone, which are common in the slates and conglomerates on the head of Little River. Much prospecting has failed to disclose productive beds, and the gold is probably too small in amount to be recovered until concentrated in the streams.

Lime and cement. The marbles of the valley are used for the production of lime and cement. Kaolin from these beds immediately furnishes the material for use. Some of the ore is usually of good quality, and result from the oxidation of the latter being in the clay.

Gold.—Gold has never been discovered in the region in this very small area. The choicest of the valley timbers is the white pine, and furnish abundant power. Thousands of falls are produced in the smaller creeks by hard beds of rock, such as the upper sandstone of Glenville sandstone, and furnish abundant power. The streams of size similar to Little Pigeon and Little rivers and smaller fall are used for power. The streams of size similar to Little Pigeon and Little rivers and smaller fall are used for power. The streams of size similar to Little Pigeon and Little rivers and smaller fall are used for power. The streams of size similar to Little Pigeon and Little rivers and smaller fall are used for power.