The Appalachian province.

The Appalachian province is a large area of land in the southeastern United States. It is characterized by a series of mountain ranges and valleys that extend from the Ohio River in the west to the Atlantic Ocean in the east. The province is divided into several smaller regions, each with its own distinct geologic and topographic features.

Geography.

General relations. The terrain represented by the Pocahontas sheet is characterized by a series of mountain ranges and valleys that extend from the Ohio River in the west to the Atlantic Ocean in the east. The province is divided into several smaller regions, each with its own distinct geologic and topographic features.

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1. The Allegheny Highland, which is characterized by a series of mountain ranges that extend from the Ohio River in the west to the Blue Ridge Mountains in the east.

2. The Blue Ridge, which is characterized by a series of high peaks and deep valleys that extend from the Allegheny Highland in the west to the Great Smoky Mountains in the east.

3. The Great Smoky Mountains, which are the highest mountains in the eastern United States and are characterized by a series of peaks and valleys that extend from the Blue Ridge in the west to the Great Smoky Mountains in the east.

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it becomes a canyon with precipitous sides, so that Ping, Crane, Widemouth, Rich, and Camp creeks. rising in Burke Garden, flows east along the south­
forming quite a large stream. From this point
River Mountain to New River. Wolf Creek, mountains. South of Big Walker Mountain a small area is drained by Reed Creek, another branch of New River. The North Fork of the Holston River drains the region south of Clinch Mountain and west of Sharon Springs. North of Clinch Mountain and west of a line drawn from Hutchison Rock to Tip Top are a few of the head waters of Clinch River. This stream, as well as the larger one of the North Fork of Holston, are the only representatives of the Ten­
River system in this territory. In the northwest the Holston, Big Walker, and Big Sandy rivers. The portion north of Indian Creek and west of Wytheville, is in the drainage basin of the Holston. The area drained by this stream is insignificant in size, but is destined to become of importance when mining is begun on the coal which underlies its basin. The best-known valley in McDowell County is that of Elk Creek, which is now the center of coal and coke production in the vicinity of landing, Box­
and Flat Top field. In Wyoming County the principal stream is Pinacle Creek, one of the head branches of Gurryd River.

GEOLOGY.

STRATIGRAPHY.

The general sedimentary record.—All of the rocks appearing at the surface within the limits of the Clinch basin are of relatively recent origin—that is, they are deposited by water. They consist of sandstone, shale, and limestone, having an average total thickness of 18,000 feet and presenting great variety in com­
position and appearance. The materials of which they are composed were derived from the waste of older rocks, and the remains of plants and animals which lived while the strata were being deposited. The sea in which these sediments were laid down covered most of the Appalachian province and the Mississippi basin, but it probably varied from time to time within rather wide limits. As a rule, the younger rocks are limited in their outcrop to the northwestern side of the Appa­
chian Valley, whereas the older rocks are generally more exposed along its southeastern side. Whether this is due to the more extensive folding of the latter portion, by which the lower rocks have been brought within reach of erosion, or to the early folding and elevation above sea-level of the southeastern portion and the non-deposition of the latter sediments over this land area, is as yet an unsolved question. In this territory, how­
er, Clinch rocks occur on the northern edge of the valley at the eastern end of an extensive calcareous formation which, as it extends backward, is in such a manner that the Clinch rocks are thrust over the Coast Measures.

CUMBERLAND STRATA.

Dormant formation.—The outcrop of Clinch rocks appears to be limited, north to the week of Witten Mills in Tazewell County, Virginia, and consists of variegated shale and impure limestone. The total thickness of these rocks is not known, but it does not exceed 500 feet, though farther west there are certainly visible 1,000 feet of the same formation. In this territory the sequence is apparently unfolded, but in its fuller development it contains the Omohannza fauna of Lower Cambrian age. This formation, so named because its greatest develop­ment is in Russell County, Virginia, is probably the same as the "shale of Clinch Mountain," the "Apalachian shale of southern Tennessee," described by the Chattanooga and Ringgold follow.

"CAMBRIAN STRATA.

Shenandoah limestone.—The great sheet of limestone which underlies this formation is more or less exten­
tensive with the Appalachian Valley is well exposed in the southern half of this territory. It is composed of a calcareous formation, largely tuffaceous, very rich in shells, and forms a prominent cliff along the valley of the Big Sandy River. This formation can not be correlated with the Knox limestone, a formation which can not be correlated with the Knox formation but at least 1,500 feet of Cambrian strata beneath it.

Throughout southwestern Virginia this forma­tion shows considerable change in character across the strike, or in a north-south-east direction. On the northern side of the valley it probably does not exceed 500 feet in thickness, and carries various kinds of limestone, but in general it is well bedded, and has its greatest development near the margin of the Appalachian Valley. In this territory the formation is most prominent, and is the upper part of the Clinch formation to be divided between the Guyandot and Clinch Mountains.

Shenandoah limestone.—This formation is in Russell County, Virginia, is probably equivalent to the base of Rogers's Nos. III and IV, and here it has been termed the "Shenandoah limestone," a formation which has preserved its summit at least 1,500 feet of Cambrian strata beneath it.

In many places the top of the Shenandoah limestone is marked by a conglomerate composed of a calcareous matrix with pebbles of sandstone, vein quartz, and quartzite. Nowhere in this territory are the pebbles known to exceed 2 inches in diameter, but the formation is from 5 to 10 feet in thickness, and carries various kinds of limestone, but in general it is well bedded, and has its greatest development near the margin of the Appalachian Valley. In this territory the formation is most prominent, and is the upper part of the Clinch formation to be divided between the Guyandot and Clinch Mountains.

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increasing to nearly 4,000 feet on its eastern
boundary. It is a bright-red shale, which appears to be the place at which this important coal was first opened.

**Hinton formation.**—Two or three coal seams are found in the lower portion of the formation, but conditions do not appear to have favored the development of the coal plant until the close of the deposition of the formation and the beginning of the deposition of the vegetable matter which has since become solidified into the Pocahontas coal. This seam varies in thickness from about 10 feet at Pocahontas to 6 feet in thickness on the headwaters of the Guyandot River, in the northern part of the field. The Pocahontas formation appears to hold a constant thickness of 300 feet throughout this entire area. Its principal lines of outcrop are as follows: (1) It extends along the southeastern border of the field, with a line of outcrop along the Bluestone River. (2) In the vicinity of Prairie Coal the formation is exposed on the crests of most of the folds and possesses a reliable local horizon for mapping purposes. All the rocks, from the top of the red sandstone to the base of the quartzite forming Stony Ridge, are necessarily limited to the small area through which the Pocahontas formation is known. (3) It is named from the vicinity of Anniston, Alabama; at Chattanooga it is exposed in two lines of outcrop, across which it is exposed in two lines of limited outcrop. It is a bright-red shale, which appears to be the place at which this important coal was first opened.

**Bluefield formation.**—The division-line betweenDevonian and Carboniferous rocks in this region is arbitrary, on account of minor differences in the sandstones, which may or may not be con-
stant over larger areas. But since the shale below the base of the Carboniferous rocks is well marked, this division is usually taken at the base of the Bluefield formation, which appears to be the place at which this important coal was first opened.

**Pocahontas formation.**—The upper portion of the formation is usually absent throughout the whole region, but it has been laid bare in a few instances. It is a thick, black, coal-bearing formation, and is usually about 300 feet thick. Near the edge of the territory it is a coarse, massive sandstone, which has been quarried for heavy masonry.

**Rogers's No. XI.**—This formation is named from Rogers's No. XI, is named from Bluefield, Mercer County, West Virginia, the most important town in the Pocahontas area. It is a bright-red shale, which appears to be the place at which this important coal was first opened.

**Hinton formation.**—Extending upward from the base of the formation in the Appalachian province. Thus, the entire Devonian series is probably wanting in the vicinity of Abbs Valley. On the eastern side of this territory, rocks lie so high that the streams have cut through them, and in this region the Pocahontas formation is entirely wanting. It is named from Bluefield, Mercer County, West Virginia, from which it is named. In thickness it varies from a maximum of 500 feet on the eastern side of this territory to 20 feet or less on the western edge, and probably is wanting altogether a short distance beyond the limit of the territory.

**Greenbrier limestone.**—This formation consists generally of heavy, blue limestone, cherty at some horizons; and is from 50 to 200 feet in thickness. Toward the top it becomes shaly and passes into the Paleozoic formation of the same name. In the Pocahontas region it is a coarse, massive sandstone, which has been quarried for heavy masonry. It is named from the town of Quinnimont, on the west side of the coal field, west of Smith Store, there are several seams of coal at about the Quinnimont horizon, which have been called the Pocahontas formation. A heavy seam has been opened at Smith Store, which is a small one, and is a prime example of the Pocahontas formation. It is named from the vicinity of Anniston, Alabama; at Chattanooga it is exposed in two lines of outcrop, across which it is exposed in two lines of limited outcrop. It is a bright-red shale, which appears to be the place at which this important coal was first opened.

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the valley the rocks have been steeply tilted, bent into folds, broken by faults, and to some extent altered into slates. In the mountain district faults and folds are the most important features of the structure, but the form of the rocks has been changed to a greater extent by cleavage and by the growth of Grit, mica, and other secondary minerals. In the folds and faults are parallel to the old shore line along the Blue Ridge, extending in a northward and southwest direction for great distances. Some of these faults have been traced 300 miles, and some faults even farther. Many folds maintain a uniform dip parallel to the neat of the slope in the bottom of the syncline. The folds are also approximately equal to one another in height, so that many parallel folds bring to the surface the same formations. The rocks dip at all angles, and the sides of the folds are compressed until they are parallel. Where the folds have been overturned, it is always toward the north-west, producing southeastern dips on both limbs of the fold. In the southern portion of the Appalachian Valley, where this type of structure prevails, a nearly bed can be found which dips north and northwest.

Out of the overturned folds the faults were developed, and with few exceptions the fault plane dips toward the bedded planes. Along these planes of fracture the rocks moved to varying distances, some as great as 300 miles, and some farther. Many new folds have been developed in Pennsylvania, and all are of increased magnitude, but the folds are open, and, as a rule, the dips are gentle. This structure holds such a thrust upon the northern limb of the syncline.

In the Appalachian Mountains the same structure is found that marks the Great Valley, such as the eastward dips, faults, and the thrust of the folds, etc. In addition to these changes of form, which took place mainly by motion on the bedded planes, there was a local movement by faulting. In southern Virginia, where a few folds on the eastern side of the Great Valley have been compressed to such an extent that they are overturned. In southeastern Virginia and northern Tennessee faults become more common, and open folds are the exception. From central Tennessee to Georgia and Alabama almost every fold is broken, and the strata form an imbricated structure, in which all of the beds dip to the southeast. Throughout Alabama the faults are fewer in number, their horizontal displacement is much greater, and the folds are more nearly vertical.

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The importance of the Pocahontas region is its economic aspect. The seams there are not varied, but, so far as known at present, include coal, iron, molybdenum, and strata. By the coal production of the United States. Although the coal field is affected by the faulting of its southern limb and the overthrust of Mount Coker within the section of the Pocahontas coal, the folding of which end before reaching the edge of the syncline, and forms, by its gentle uplift, the western edge of the syncline, and forms, by its gentle uplift, the bottom of the syncline. These irregularities are shown on the economic sheet by contour lines of different sizes, by a vertical contour interval of 100 feet.

North of this line the strata are highly complex, and the coal seams are of variable thickness. North of this line the strata are nearly horizontal, and the seams are shown on the economic sheet by contour lines of different sizes, by a vertical contour interval of 100 feet.

South of this line the strata are highly complex, and the coal seams are of variable thickness. North of this line the strata are nearly horizontal, and the seams are shown on the economic sheet by contour lines of different sizes, by a vertical contour interval of 100 feet.

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crop it shows the following section:

<table>
<thead>
<tr>
<th>Coal</th>
<th>Slate sandstone</th>
<th>Shale sandstone</th>
<th>Slate</th>
<th>Coal</th>
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There has been doubt about the identity of this seam, but the fossil plants collected from its roof-shales, corroborated by stratigraphical evidence, clearly show that it is not the same as No. III, but belongs to a considerably higher horizon.

The character of the Pocahontas coal is too well known to require a full discussion here. It has acquired foremost rank as a steam coal, and finds a ready market at the seaports in supplying ocean steamers. It also produces an excellent coke, which, however, generally requires to be crushed in order to yield the best results. As a rule the lump coal is placed directly upon the market for general purposes, while the slack and fine coal goes direct to the cokes and is coked.

There is a small coal field in the southern portion of this territory in which the coals are of Lower Carboniferous or Pocahontas age and are found in the Price sandstones. The seams are, as a rule, small and much broken up by partings; the rocks are frequently highly tilted and more or less crushed; and the coals are generally high in their percentage of ash. From time to time the deposits of variegated marble, in the Pocahontas region, generally a blue limestone, carrying marlstone at each locality. This is at the northern base of Big Walker Mountain, in the great bend between Blair and Sharon Springs. The marble is coarse crystalline and of a light-gray color. It occurs in the Pocahontas field it appears to be more generally a blue limestone, carrying marble at the surface or through the various under-lying formations. Since the crests of the ridges are always formed by beds of sandstone, the overplaced sand is universally sandy and detrimental to the soil of the valley below.

Sandy soils.—Such formations as the Bays, Clinch, Rockwood, Price, and Princeton sandstones, together with much of the coal-bearing rocks, give a poor soil, varying slightly as the rocks vary from which it is derived. Pure sandstone, like the Clinch and some beds in the Carboniferous series, produces nothing but white or yellow sand, whereas other sandstones associated with it produces sandy clay soil. Soils derived from sands.—Since there are in general three kinds of sand—variegated, aluminous, and calcarious—it follows that the resulting soils will range from sandy clay to a rich limestone clay, with all the intervening grades. The Knox claystone gives the poorest soil of this region, but little of its outcrop being cultivated. Many of the coal-bearing shales form but little detritus. The actual shale formations of the Lower Carboniferous produce much better soils, for many of their beds are strongly carbonaceous and contain large proportions of the overlying clays. As a producer of rich soils the Chickamauga shale is equally rich in lime, and the surface is rather poor and agriculture in any degree of success. The great shale formations of the valley below, as the Clinch and some beds in the Carboniferous series, produces nothing but white or yellow sand, whereas other sandstones associated with it produces sandy clay soil. Soils derived from sands.—Since there are in general three kinds of sand—variegated, aluminous, and calcarious—it follows that the resulting soils will range from sandy clay to a rich limestone clay, with all the intervening grades. The Knox claystone gives the poorest soil of this region, but little of its outcrop being cultivated. Many of the coal-bearing shales form but little detritus. The actual shale formations of the Lower Carboniferous produce much better soils, for many of their beds are strongly carbonaceous and contain large proportions of the overlying clays. As a producer of rich soils the Chickamauga shale is equally rich in lime, and the surface is rather poor and agriculture in any degree of success. Therefore it is not surprising that the soils derived from these formations are of low order. Considered as a whole, the territory may be divided into three agricultural districts: (1) The Clinch River and Laurel Creek, in which the soil is exceedingly poor, capable of producing but little more than meets the demands of the present scanty population outside of the mining districts. (2) The eastern half of the territory, including the southern half of Mercer, the western part of Blair, and a small portion of Wythe counties. This is an area of medium value. It has a few rich valleys, but on the whole the soil is rather poor and agriculture is not in a flourishing condition. (3) Tazewell County, one of the richest agricultural districts of Virginia, and long famous for its live stock.

MARIUS R. CAMPBELL, Geologist.
April, 1895.