DESCRIPTION OF THE KINGSTON SHEET.

GEOGRAPHY.

General relations.—The Appalachian province may be subdivided into three well-marked portions or districts, each of which is characterized by topographic features. Only a part of this history can be read from the map as a whole, and it is necessary to consider the individual sheet in its relations to the entire province.

Subdivision of the Appalachian province.—The Appalachian province may be subdivided into three well-marked portions or districts, each of which is characterized by topographic features. Only a part of this history can be read from the map as a whole, and it is necessary to consider the individual sheet in its relations to the entire province.

Alluvial plain of the Appalachian province.—The alluvial plain of the Appalachian province extends from southern New York to central Alabama, and includes the Bootheel plains, the Cumberland valley, and the Tennessee river valley. This plain is characterized by its low relief and its extensive areas of alluvial deposits. The streams which drain this plain are generally characterized by meandering courses and by the presence of levees and benches along their banks. The soil of this plain is generally favorable for agriculture, and it is one of the most productive areas of the Appalachian region.

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**GEOLGY.**

**STRATIGRAPHY.**

The sedimentary record.—All the rocks appearing at the surface within the limits of the Kings- ton atlas sheet are of sedimentary origin, that is, they were deposited by water. They consist of sandstones, shales, and limestones, representing great variety in composition and appearance. The materials of which they are composed were originally of granular, coarse, and only rarely of fine texture. Many of the older rocks, or the remnants of plants and animals which lived while the strata were being laid down. Thus some of the sandstones were formed largely from the shells of various sea animals, and the beds of coal are the remains of plants which, probably covered low, swampy areas.

These rocks afford a record of almost uninterrupted sedimentation from early Cambrian to Carboniferous times. Their composition and appearance indicate the nearness to shore and the depth of water in which they were deposited. Sandstones marked by ripples and cross-bedded by currents, and shales cracked by the sun on exposed surfaces indicate water action. Where the strata are nearly horizontal layers, with a gentle slope upward into the rock, the strata were deposited by a calm sea, and the claystones to which they may have been converted later, indicate a quiet bottom. Where the strata show a regular sequence in the order of the rock formation and in thickness, where the strata are marked by characteristic groups of rocks, and where the general slope of the surface is a continuation of the underlying strata, there is probable evidence of a definite rising or sinking. Where the strata show no regular sequence, or where the beds are of greatly varying thickness, there is evidence of the electric or tectonic action of the earth.

Two great cycles of sedimentation are recorded in the rocks of this region. Beginning with the first definite record, coarse sandstones and shales were deposited in early Variscan time along the eastern border of the interior sea as it encroached upon the land. As the land was worn down and was further depressed, the sea, including the Devonian seas, advanced in later periods, and in the Knox dolomite of the Cambro-Silurian period probably reached its maximum depth over the entire surface. For a long time after the sea withdrew, the thick deposits of shale were converted into sandstones, as the surface drained off toward the sea. The thickness of the formation is 1,000 to 2,000 feet, and it is the oldest rock formation of the Appalachian province except along the Ohio river near Cincinnati. The presence of the Knox dolomite on the eastern edge of the area and in the Cumberland escarpment where it forms the lower portion of the Knox dolomite, indicates that these rocks were deposited during the first great cycle of sedimentation, and that the surface of the land was elevated below sea level during the second cycle.

The Knox dolomite is a fine-grained, white, compact limestone that is often found in the upper part of the Chattanooga black shale. It is rich in carbonates of lime and magnesium, and contains a large amount of pyrite, which it often carries, has given rise to much attention from miners, and has been prospected in many places for coal and for various ores, especially silver and copper. This exploitation, however, has been almost entirely abandoned, since there is no evidence of present economic importance in the shale. Although it contains a large proportion of carbonates, which has been used by the geologists for obtaining coal and other minerals, it is very difficult to find a sufficient supply of coal to be worked for a distance of more than a few miles from the source.

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but the faults become fewer in number and their
ward Virginia they rapidly become more nume­
to the bedding planes, as the rocks slipped on the
was somewhat developed in the valley, but not to
minute breaks across the strata, producing cleav­
were accompanied by growth of new minerals out
of the fragments of the old. These consisted
were fractured, and the rocks have been
have been tilted from their original horizontal
profile are not exaggerated, but show the actual
surface the same formations. Most of the rocks
folds are somewhat more open.
which their position is measured up or down in
intervening anticlines are occupied by the faults.
The structures above described are manifestly
which the main entry is driven, there dip north­
shale or Rome sandstone, while on the eastern
shales, which have been separated by a nearly
Their movements have resulted in weaving a sea
face, and the greatest uplift has occurred nearly
along the line of the great valley.
structures are manifestly different types of structure,
and it occurs in small rhom­
occupied the entire surface of the sheet west of
the Cambrian rocks are
The benches dip to the west from 30 to
its western side the Rockwood and Chicka­
been worked at numerous points along the escarp­
isa bed which seems
to be commercially important is the red
ite of the escarpment. Between Rhea springs, shown in section E.
The only iron ore sufficiently abun­
to be commercially important is the red
the fault plane, the arrows indicating the direction in
D. On its eastern side the Knox dolomite and
or on its western side the Rockwood and Chicka­
the coal beds, for the strata dip under the older
or limestone. This is due to the fact
nearly a horizontal fault, on which
the movements have resulted in weaving a sea
out from these parts of the faults where the pressure
was released. In some places the coal is eightly to
one hundred feet thick. Its original structure is
made of oolitic ironstone, which has been separated
through the unfavorable conditions, considerable mining has been done in this area, generally by surface trenching.
the Rockwood formation thickens toward the east, but the calcareous beds with which the iron
carried by the waters of the upper portion. In the
river, where the sheet is about ten feet thick at the
west, but there are some
creasing a series of narrow, parallel folds similar to the
Knox dolomite. The eastern belt is about twenty miles in
length, and the ore shows an increase in the proportion of lime, it can probably be worked with profit to
the bed where it is not of sufficient thickness to
The Rockwood formation extends from the
sheet, except at points where a number of short
reach of the Valley rock, and it occurs in considerable depth.
months. The ore occurs in
workable quantity along this whole strip, though it is thicker in the northern than in the southern half.
iron ore is produced by surface trenching. Between Rockwood and Emory gap there are two beds of ore, one
about 200 feet and the other 500 feet below the Chickamauga black shale. Only the upper bed is
worked at present, its thickness varying from three to
half to five feet. The workings have
within 75 feet from the surface, and while the ore shows an increase in the proportion of lime, it can probably be worked with profit to
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SOILS.

Throughout this region there is a very close relation between the character of soils and that of underlying geological formations. Except where in limited areas along the rivers and the steep slopes of the Cumberland escarpment, the soils are derived directly from the decay and disintegration of surface rocks. Where these are sandstones or sandy shales the resulting soil is sandy, where they are clay shales or limestones the soil is clay. As there are abrupt changes in the character of the rocks, sandstones and shales alternating with limestones, so there are abrupt transitions in the character of the soil, and soils differing widely in composition and agricultural qualities often occur side by side. The attitude of the strata and the consequent breadth of outcrop of each formation determine the area of the derived soil. Where a formation is nearly horizontal at the surface, as the Walden sandstone of the plateau, the corresponding soil covers a broad area, but where its outcrop is nearly vertical, as the Connasauga shale, its resulting soil covers only a narrow strip. The character of the soils derived from the various geological formations being known, their distribution may be determined from the map showing the areal geology, which thus serves also as a soil map.

Classification.—The soils of this region may conveniently be classed as (1) sandy soils, derived from the Walden and Lookout sandstones, some parts of the Rockwood formation, and the Rome sandstone; (2) clay soils, derived from the Bangor and Chickamauga limestones and the Connasauga and Apison shales; (3) cherty soils, derived from the Fort Payne sheet and Knox dolomite; and (4) alluvial soils, deposited by the rivers upon their flood plains.

Sandy soils.—The Cumberland escarpment has already been described as separating the area of the Kingston sheet into two nearly equal divisions, which differ widely in topographic features and geological structure. The difference in soils is also marked. Northwest of the escarpment the rocks are sandstones and sandy shales, and, except in the cover which is underlain by limestones, the soil is a sandy loam. At the surface it is gray, while the subsoil is generally light yellow, but varies to deep red. It usually contains sufficient clay to give the subsoil such cohesion that a cut bank will remain vertical for some years. The depth of the soil on the plateau varies from a few inches to a dozen feet, depending chiefly on proximity to streams and the consequent activity of erosion. Almost the whole of the plateau retains its original forest growth, chiefly of oak, chestnut, and hickory, while pine clothes the steep sides of the stream channels. The practice of burning off the leaves each fall prevents the accumulation of vegetable mold and has delayed an appreciation of the agricultural possibilities of this region.

The sandy soils southeast of the escarpment are confined to a few narrow strips coinciding with the outcrop of the Rockwood and Rome sandstones. These formations, however, produce sharp ridges, so that their soils are not agriculturally important.

Since the sandstones of this region occupy the highest land, the sandy soil is often washed down to lower levels and covers up the clay soil of adjacent valleys. This happens along the Cumberland escarpment, so that the strip of Bangor limestone at its base is covered by sandy soil instead of clay soil.

Clay soils.—In the course of the Crab Orchard mountains the surface of the Bangor limestone is covered by a thin mantle of bluish gray clay soil, formed from its erodable portions. Southeast of the escarpment the many parallel valleys are due to the presence of narrow belts of soluble limestone or easily eroded shales, which form clay soils. The most productive of these are derived from the Chickamauga limestones, and their distribution coincides with that of the formation as shown on the geologic map. They have generally a deep red color, but where the mantle of residual material is thin, the soil is often dark bluish gray. The clay soils derived from the Cambrian shales are somewhat less productive. The Connasauga and upper part of the Rome make stiff, bluish gray soils, thinner than that covering the limestones, the shaly structure often appearing a few inches below the surface.

Cherty soils.—About half the area southeast of the escarpment is underlain by the Knox dolomite. The soil derived from this formation consists of clay, in which chert is inbedded. The proportion of chert to clay is variable; in some places only occasional fragments occur, while in others the residual material is made up almost wholly of chert. Where the clay predominates the soil is deep red, but becomes lighter with the increase in amount of chert, and in extreme cases is light gray or white. Even when the proportion of chert is very large this is a strong, productive soil, especially adapted to fruit raising. The soil derived from the Fort Payne chert is similar to that from the Knox dolomite, but the areas of the Fort Payne outcrops are so small that their soil is relatively unimportant.

Alluvial soils.—These are confined to the flood plains or bottoms of the Tennessee and Clinch rivers. Their areas are small, as the rivers are usually bordered on one side or the other by steep bluffs. The soil is a rich, sandy loam, containing a considerable proportion of fine mica scales derived from the crystalline rocks far to the east.

C. WILLARD HAYES,
Geologist.

May, 1894.