DESCRIPTION OF THE LONDON QUADRANGLE.

GEOGRAPHY.

General relations.—The territory represented by the London atlas sheet embraces an area of 904.4 square miles, extending from latitude 36° on the north to 36° 30' on the south, and from longitude 84° on the east to 84° 30' on the west. It includes, wholly or in part, the counties of Laurel, Rockcastle, Lincoln, Jackson, and Garrard, and it is named from London, the principal town within its borders. The adjacent quadrangles, as far as surveyed, are Richmond on the north, Beattyville on the northeast, Manchester on the east, Cumberland Gap on the southeast, and Williamsonburg on the south.

In its geographic and geologic relations this quadrangle is situated in the easternmost portion of the Cincinnati arch of Kentucky, which extends from the Atlantic coastal plain on the east to the Mississippi lowlands on the west, and from central Alabama to southern New York.

Subdivisions of the Appalachian province.—Upon the surface, the waters of the Appalachian province may be divided into two nearly equal portions by a line which follows the northwestern side of the Appalachian Valley along the Allegheny front and the eastern escarpment of the Cumberland tableland. East of this line the rocks are greatly disturbed by immemorial faults and folds, and in many places they are so metamorphosed that the species of rocks that once occupied the strata can not now be determined. West of the line the rocks are less greatly disturbed and the strata lie nearly flat, in the attitude in which they were deposited on the bottom of the sea. Since the western division is almost wholly within the boundaries of the Coal Measure region, the strata there can not now be determined. The southeastern portion of the territory is occupied by the rocks of the Cincinnati arch, which is continuous with the adjacent counties of Pulaski, Laurel, and Rockcastle in Tennessee, Kentucky, and Ohio. Its northeastern boundary is indefinite, but it may be regarded as coinciding with the Mississippi River as far as the stream at Cairo, and thence extending northward across the States of Illinois, Indiana, and Ohio to the western end of Lake Erie. Compared with the intensely folded strata of the Appalachian Valley the rocks of this region may be classed as horizontal, but, strictly speaking, they are not horizontal, for a minor fault is continuous with one outcrop to another, and that the underlying tilting of the Appalachian Valley is probably more pronounced in the Cincinnati arch than in the Appalachian Valley. The latitude of the Cincinnati arch is generally from 1500 to 1700 feet, and it has a breadth of about 250 miles.

The most promiment structural feature of the Ohio Basin is an arch in the strata, which has been styled the Cincinnati arch or syncline. The main portion of the fold enters the basin, as it is here outlined, from the direction of Ohio; it curves southward through Cincinnati and Lexington, Kentucky, and continues southwestward to Nashville, Tennessee. Originally the principal arch was supposed to extend northeastward from Cincinnati to Toledo, but evidence afforded by numerous oil and gas wells in that region has proved that the Toledo fold is only a small branch of the principal uplift. Stratigraphically the maximum development of this fold is found in the vicinity of Lexington, where the Trenton limestone is at an altitude of 1000 feet above sea level. Geologically this arch separates the Ohio drainage basin into two parts, or structural basins, each of which contains coal-bearing rocks. The chief of these basins is the Cincinnati syncline, which is generally known as the Appalachian coal field, and that on the western side as the Bluegrass Basin, or the central coal field of the United States. Besides these main structural basins, the rocks of the Ohio Basin have been disturbed by a few small faults, and in places they have been broken by small folds.

The principal escarpment of the Cincinnati syncline at this particular point is destitute of its characteristic features. The principal rocks do not extend outward to the margin of the fold, and consequently the upper plain and the escarpment are lacking.

The major portion of the territory is drained by the Rockcastle River, which unites with the Cumberland River in a narrow angle near the line of the escarpment, and is the southern margin of the quadrangle. The Rockcastle River, throughout its entire course, forms a narrow valley bounded on either side by perpendicular cliffs and sandstone. Its tributaries are the Blackburn, Green River, and others, which unite to form the Rockcastle River. The tributaries of this river are mostly suspended in a high, broad valley which is generally known as the Black Fork and Black River drainage basin. The principal streams of the region are the big branch of the Kentucky River, the Hollow River, and the Whitley Forks. The only large tributary of the Ohio River is the Big Sandy River, which unites with the Ohio River at Portsmouth, Ohio.

Topography of the London quadrangle.—The London quadrangle is located about 200 miles northwest of the Appalachian coal field, which at this particular point is destitute of its characteristic features. All the rocks do not extend outward to the margin of the fold, and consequently the upper plain and the escarpment are lacking.

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interval and the original thickness of inerva into the limestone to a depth of 100 feet. The deposits are unknown. In the uplift which extending in some cases through the shale and into the limestone to a depth of 100 feet.

This erosion interval represents, without doubt, the earlier portion of Coal Measure time, when the Cincinnati arch was the dry land separating the two coal basins of Kentucky. At the beginning of this period, a new series of shallow lakes swamps flourished along its marshy borders, while the London quadrangle was dry land. Gradually the land was encroached toward the northeast, until finally it engulfed the land of this region. The advancing shore line was marked by accumulations of sand and gravel which filled the inequalities of the land and which have since been consolidated into sandstones and conglomerates. During the long periods which have since elapsed no marine sediments have been deposited on the surface, but the events of the passing ages are recorded in the forms sculptured from the land and in the river deposits. They have been suggested under the heading "Topography."
for erosion, and consequently it forms the foundation for an extensive area of nearly level land; in the southern portion the distance between it and the limestone is so great that it forms a cut deep channel in the limestone and leaves the remnants of the conglomerate as mere caps to the hill tops.

The Lee formation is nearly equivalent to the Pottsville series of Pennsylvania, but it does not contain the coal, nor the superior or the inferior limits of the type. Probably as much as one-quarter of the lower portion of the series is missing in this section, being represented by the erosion interval at the base of the Pennsylvanian series. According to the evidence afforded by fossil plants the top of the Pottsville series occurs in a thick bed of shale which overlies the Carbondale conglomerate.

Rocks and minerals of economic importance are due to tension, or the stretching of the strata. Turned folds; but in the Ohio Basin the faults of the land and the dips of the strata are shown. Minute details of structure can not be shown on the structure as a whole. There are also such exceptions are local, but have no effect on the structure.

As the strata are examined in detail and the altitude of the sea, and since the sea bottom has generally less diversity of altitude than the present rock strata, it is evident that the uplift was due to tension and consequent movement of the crust of the earth, the strata in many places have broken along certain lines, and the rocks have been thrown into arches and troughs. In describing these folds the term syncline is applied to the downward-bending trough, the term anticline to the upward bending arch. A synclinal axis is a line running lengthwise in the syncline; and at every point occupying its lowest part, toward which the rocks dip from either side. An anticlinal axis is a line which occurs by the writer, but if it has the thickness of a foot, it is not known, and its variability is of great force.

The surface of this quadrangle is too deeply cut by streams to make good farming lands. There are, however, two areas of low relief which, so far as the surface is concerned, are tolerably well adapted to agricultural purposes, but which are very different in value on account of the difference of the soil. One of these areas is composed of the outcrop of the Newman limestone in the western portion of the quadrangle. The limestone is less, allowing the streams to flow more freely, and consequently the soils can not compare with those of the "Bluegrass" region, which are derived from the Silurian limestones. The soil characterizing the Newman limestone is easily exhausted, and when once worn out, it will not renew itself, but requires artificial fertilizers.

Of the two areas of low relief which are but a few feet in thickness. It was found in a number of ravines south of Mount Sterling knob, and also for use as road metal, but it has been utilized only in a small way. The surface indications of iron ore are common, but no deposits of value are known in the territory. From time to time interest has been manifested in the search when transportation can be secured.

MINERAL RESOURCES.

Rocks and minerals of economic importance are not very plentiful in this quadrangle. Coal, building stone, limestones, road metal, clay, and sand are present in the district in general abundance. The two most important mineral resources of the quadrangle have been misused for a number of years at Pine Hill and Livingston, but these deposits are now pracically exhausted, and the production of coal is limited to the neighborhood of Pittsburg, where nine or ten companies are actively engaged in mining. The railroad to Racoon Creek. It was formerly opened and worked to some extent at Lily, but the seam was too thin for profitable mining and was abandoned. Now it is worked on the southern edge of the coal swam, for in a cut north of town it shows only 12 inches in thickness. More recently, development, near Pittsburg, is ranging in thicknesses from 56 to 41 inches. It is mined by eight or ten companies in and about Pittsburg, and finds a ready sale as a steamin and domestic fuel.

A few small seams occur in the country east of Pittsburg, but it is probable that they are of no present commercial value.

Building stone.—Along the valley of Round-stone Creek the Waverly formation carries a bed of fine building stone, which has been quarried at Langford for a number of years. It consists of a fine-grained bluish sandstone, which when freshly quarried but which soon hardens by the action of the elements into a very durable stone. Its principal defect is the thinness of the bed of workable stone, which renders quarrying unprofitable as soon as the cover becomes of moderate thickness.

Stone for rough work could be found at a number of places, both in the limestones of the Miss­issippi and in the sandstones of the Pennsyl­ vanian series, but it has never been used except for local purposes.

Limestone.—This kind of rock is abundant in the western portion of the quadrangle. Much of it is of good quality for the manufacture of lime, and its annual production is considerable, but it has been utilized only in a small way.

Mississippian.—Beauchy clay of good quality has been used for the manufacture of brick, but it could be obtained only at many points on the limestone outcrop, but it has never been fired. Fire or under clay accompanies many of the coal seams, but it has never received attention, and its value is not accurately known. Surface indications of iron ore are common, but no deposits of value are known in the territory. From time to time interest has been manifested in the search when transportation can be secured.

The Waverly formation produces hilly lands and a soil so poor that it is almost valueless for farming purposes.

M. R. CAMELLE, Geologist.

February, 1888.
## Generalized Section for the Northern Half of the London Quadrangle

**Scale:** 500 feet = 1 inch

### Carboniferous Period

<table>
<thead>
<tr>
<th>Formation Name</th>
<th>Symbol</th>
<th>Columnar Section</th>
<th>Thickness (ft)</th>
<th>Character of Rocks</th>
<th>Character of Topography and Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Corbin conglomerate-lentil.)</td>
<td>Ccl</td>
<td></td>
<td>9–120</td>
<td>Conglomerate or coarse pink sandstone.</td>
<td>Rounded ridges. Sandy soil.</td>
</tr>
<tr>
<td>Pennington shale.</td>
<td>CS</td>
<td></td>
<td>6–8</td>
<td>Red and green shale and thin lignite.</td>
<td>Clay soil.</td>
</tr>
<tr>
<td>Newman limestone.</td>
<td>Cs</td>
<td></td>
<td>100–200</td>
<td>Blue limestones with a few nodules of chert.</td>
<td>Cliff and hill lands. Generally fertile soil where slopes are not too steep.</td>
</tr>
<tr>
<td>Chattanooga shale.</td>
<td>Ch</td>
<td></td>
<td>300</td>
<td>Light-blue clay shale with iron concretions.</td>
<td>Very poor soil.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Valleys. Poor soil and bad roads.</td>
</tr>
</tbody>
</table>

### Names of Formations

- Breathitt formation.
- Corbin conglomerate-lentil.
- Lee formation.
- Rockcastle conglomerate-lentil.
- Pennington shale.
- Newman limestone.
- Waverly formation.
- Chattanooga shale.
- Panola formation.

## Generalized Section for the Southern Half of the London Quadrangle

**Scale:** 500 feet = 1 inch

### Carboniferous Period

<table>
<thead>
<tr>
<th>Formation Name</th>
<th>Symbol</th>
<th>Columnar Section</th>
<th>Thickness (ft)</th>
<th>Character of Rocks</th>
<th>Character of Topography and Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathitt formation.</td>
<td>Br</td>
<td></td>
<td>500</td>
<td>Sandy and coarse ferruginous sandstone.</td>
<td>Hilly country, with gentle slopes and rounded summits. Soil fair on shale outcrop, poor on sandstone.</td>
</tr>
<tr>
<td>(Corbin conglomerate-lentil.)</td>
<td>Ccl</td>
<td></td>
<td>50–150</td>
<td>Conglomerate or coarse pink sandstone.</td>
<td>Cliffs. Sandy soil.</td>
</tr>
<tr>
<td>Lee formation.</td>
<td>Le</td>
<td></td>
<td>500–700</td>
<td>Sandy shale and sandstone with a few seams of coal.</td>
<td>Generally rolling upland in the vicinity of London, and gentle to moderate basin south. Formally poor soil. (Cliffs. Sandy soil.)</td>
</tr>
<tr>
<td>(Rockcastle conglomerate-lentil.)</td>
<td>ROe</td>
<td></td>
<td>5–100</td>
<td>Coarse conglomerate.</td>
<td>Very poor soil.</td>
</tr>
<tr>
<td>Pennington shale.</td>
<td>CS</td>
<td></td>
<td>0–150</td>
<td>Red and green shale and thin beds of limestone.</td>
<td>Valleys or slips. Clay soil, sometimes fertile.</td>
</tr>
<tr>
<td>Waverly formation.</td>
<td>Wv</td>
<td></td>
<td>100+</td>
<td>Calcareous sandstone.</td>
<td>Rocky valleys.</td>
</tr>
</tbody>
</table>

### Names of Formations

- Breathitt formation.
- Corbin conglomerate-lentil.
- Lee formation.
- Rockcastle conglomerate-lentil.
- Pennington shale.
- Newman limestone.
- Waverly formation.
- Chattanooga shale.
- Panola formation.

**Report:**

MARIUS R. CAMPBELL, Geologist.