
GEOLOGICAL SURVEY OF KENTUCKY

JOHN R. PROCTER, DIRECTOR.

REPORT

ON THE

GEOLOGY OF CLINTON COUNTY

WITH MAP.

By R. H. LOUGHRIDGE, PH. D.

STEREOTYPED FOR THE SURVEY BY E. POLK JOHNSON. PUBLIC PRINTER AND BINDER, FRANKFORT, KY

This page in the original text is blank.

LETTER OF TRANSMITTAL.

JOHN R. PROCTER,

Director Kentucky Geological Survey :

I have the honor to transmit herewith my report on the geologic and economic features of Clinton county. In the prosecution of the field work I received much assistance from a number of the citizens of the county, and especially from Capt. G. W. Hurt, of Brown's Cross Roads, and A. G. Long, of Albany.

The chemical analyses embraced in the report were made by Dr. Robert Peter, and the mechanical analyses of soils by myself for the Survey. It is a matter of regret that a collection of fossils from the geologic formations of the county were lost before being submitted for identification.

To yourself, W. M. Linney, and other officers of the Survey, I am deeply indebted for assistance and courtesies.

Yours respectfully,

FEBRUARY, 1890.

R. H. LOUGHRIDGE.

This page in the original text is blank.

CLINTON COUNTY.

The county of Clinton was organized in 1835 out of parts of Wayne and Cumberland counties, and comprises an area of about 206 square miles. Its population in 1880 was 7,212. It is bordered on the south by Pickett county (Tennessee); on the west by Cumberland county; on the north by Russell, and on the east by Wayne county, the line separating it from the latter lying in part along the crest of the Poplar Mountain.

The county occupies a position on the north-west of the great Cumberland plateau of Tennessee; a northerly offshoot of that elevated region, known as the Poplar Mountain, borders the county on the east to about its central point, and thence turning westward reaches about half way across its area. The general surface features, therefore, comprise a mountain range on the south-east and centre, and a rolling plain on the north, west and south; this plain lies about 700 feet below the mountain summits, and embraces by far the greater part of the county area. Near the mountains, on the south-east, there are isolated knobs and hills, while the surface is deeply grooved by streams, and is made rolling and uneven by their smaller tributaries and by deep gullies. The surface of the entire county was originally well-timbered, and a large proportion has been opened up for cultivation.

Elevations.—The summit of Poplar Mountain has an elevation of about 1,075 feet above low-water of Cumberland river on the north, nearly 700 feet above Albany, and a little more than 1,000 feet above the bed of Wolf river in the south-west corner of the county. The top of the conglomerate is 1,678 feet above the sea (Collins' History).

The summit of the main portion of this offshoot is quite level,

from two to three miles in width, and from its very irregular border slopes quite abruptly either to lower benches or terraces, or to the valley itself. At a distance of several miles from the main mountain Long's Gap cuts into it to a depth of some 400 feet, but the elevation immediately rises to 650 again on the summit of Jack Mountain, a small knob or point having a surface area of but about 50 feet north and south by 10 or 15 feet east and west, its sides sharply descending 145 feet to lower offshoots toward the north, and to a ridge forming a connection with Sewell's Mountain on the south-west. The latter rises to the elevation of Poplar Mountain, but has a small, level summit area of triangular form, one side trending north-east and south-west, another nearly facing the north, while the third or the westerly side and face is deeply incurved. This is the most westerly of the high mountain summits, and the range then sinks to much lower plateaus, and to Snow's Gap, whose elevation is but 50 or 75 feet above that of Albany. To the west of the gap the mountain has an elevation of but about 375 feet above Albany, and a trend nearly north and south. It is a few miles in length, and is the most westerly of the Poplar Mountain outliers. Deep coves have been formed along the sides of this entire mountain-range by the severe erosion to which it has been subjected; from the highest summit, notably from Albany Rock, splendid views may be had over almost the extent of the county to the north and south.

On the north of this central range is Short Mountain, an offshoot from the former, separated from it by a narrow and low gap, and trends northward. The mountain has about the same elevation as the main Poplar range, but is quite narrow on the summit. Its sides are steep, and on the north-west descend to a lower ridge or plateau.

Haw Mountain, an isolated knob, lies eastward from the north end of the Short Mountain. Its elevation is about 250 feet above the general surface of the valley, or 635 feet above Cumberland river.

In the south-eastern part of the county, near the main Poplar Mountain, there are several lower offshoots and isolated knobs, the highest of which is Copperas Knob, whose elevation above the valley is very nearly the same as that of the main range.

In the western part of the county there are no mountains or even prominent points, all having been removed by denudation.

Drainage.—The chief and most prominent water-divide is formed by the central Poplar Mountain range, which reaches westward more than half across the county; thence a much lower water-divide continues north-westward into Cumberland county, where it causes a sharp bend in the Cumberland river from a south to a north-west course. This elevation naturally divides Clinton county into two general water-sheds, with areas nearly equal; that on the north carrying the drainage waters by means of Indian and Willis creeks and tributaries, into the Cumberland; that of the south sending its waters through Spring and Ill Will creeks and tributaries south-westward into Wolf river, and thence into the Cumberland through Obey's river, in Tennessee.

Indian creek, on the northern slope rising at the foot of Poplar Mountain, flows for a few miles over limestone beds, and at no very great depth below the general level of the county; at Seventy Six P. O. it suddenly cuts deep into the Waverly shales, the water having a vertical fall of 86 feet and a width of from 15 to 20 feet, into a deep gorge, from which the spray rises high into the air, in sunlight presenting pretty rainbow tints. The depth of this gorge below the bordering hills is nearly 200 feet, and along its bed the waters rapidly find their way over rock fragments from the bluffs, and over shoals of Devonian slates, with scarcely any bottom land, until Frobel branch is reached. Here the bottom of the gorge and the bed of the stream widens, and the water flows quietly over a gravel bottom to the Cumberland river, with only occasional shoals produced by hard limestones. The several tributaries, rising several miles on either side, also flow in deep and narrow gorges until they unite with the main creek. The country drained by Indian creek covers, in this county, the greater part of this northern slope, or an area of about 50 square miles.

The next important stream of this portion of the county is Willis creek. It rises in the west, and flows north-westward, sinking below Lawson's Mill into a deep gorge, whose bottom is in the Devonian slates. Other small creeks in the north-west

are Salt Lick, Wells, Tear Coat and Crow, all flowing in deep and narrow channels, and but a few miles in length.

In the southern half of the county the most important stream is Spring creek. The three prongs forming its headwaters rise respectively at the foot of Poplar Mountain, in Duvall, Hog Thief and Kogar valleys. Its tributaries, Smith's creek and Albany and Ewing's branches, enter from the north, and flow with it into Wolf river. There is but little drainage from the south into the creek. The bed of Spring creek is not in a deep gorge, as is Indian creek, but for the most part in a narrow valley about 125 feet below the general level of the country.

The next stream of importance is Ill Will creek. Rising in the western part of the county, it flows in a very crooked but southerly course to Wolf river. For the greater part of the distance its bed is in deep and narrow gorges of Waverly shale, capped with St. Louis limestone, the neighboring hills rising steeply from 200 to 300 feet above it. Its chief tributaries are East branch on the east, and Sexton's and Fanny's creeks on the west.

Wolf river enters the State from Tennessee on the south, and with a general westerly course crosses and re-crosses the State line, and finally enters Obey river, in Tennessee. The bed of the river is from 25 to 50 yards wide, and is bordered by narrow bottom lands, from which the hills rise very precipitously to a height of 325 feet. The cliffs are almost vertical on the north side, and the stream usually flows at their immediate base, while on the south a narrow bottom land reaches back to the hills.

The north-western part of the county is extended into a bend of the Cumberland river, forming a small pan-handle, and it is only at this point that the river touches the county.

GEOLOGY.

Clinton county, by its position on the border of the Cumberland plateau, has within its area a small region of Carboniferous as the highest formation in the geologic series, with the exception of a little alluvium along the Cumberland river. Descending from this, we find representatives of the Upper and Lower Subcarboniferous, the Devonian and the Lower

Silurian, the exposures of the latter occurring only on the Cumberland and Wolf rivers, or respectively in the extreme northern and south-western parts of the county. This series has altogether a thickness of about 1,300 feet, distributed approximately as follows:

RECENT.—River alluvium and soil		5 feet.
CARBONIFEROUS.	Lower Coal Measures.	Conglomerate 30 feet.
		Sandstone underlaid by 3 feet of coal 48 feet.
		Sandstone, micaceous, shaly and with impressions of plants . . . 140 feet.
		Sandstone, covered by sandstone debris. 60 feet.
UPPER SUBCARBONIFEROUS.	Chester.	Shale or green marl and limestone 130 feet.
		Dark impure limestones 73 feet.
		Greenish sandstone. 25 feet.
	St. Louis.	Grey limestones, massive and pentremital; the lower 3 feet in part lithographic 148 feet.
		Grey, oolitic and semi-oolitic limestone. 50 feet.
		Cherty limestones, with <i>Lithostrotion canadense</i> 105 feet.
LOWER SUB-CARBONIFEROUS.	Waverly, Etc.	Greenish sandstones and blue limestones, with spirifer and crinoids 110 feet.
		Dark shales, with thin ledges of sandstone 270 feet.
DEVONIAN.—Black slate		30 feet.
Lower Silurian	{	Cumberland sandstone (Upper Silurian) 20 feet.
		Blue limestone—Upper Hudson—exposed to river's edge . 65 feet.

The approximate thickness of each formation in the above is as follows: Carboniferous, 273 feet; Chester, 228; St. Louis, 303; Lower Subcarboniferous, 380; Devonian, 30, and Lower Silurian exposure, 85 feet.

The divisions of the Paleozoic are thus nearly all represented in Clinton county, beginning with the highest or Carboniferous, and reaching down into the Lower Silurian, with the exception of the Upper Silurian, which, unless the Cumberland sandstone is the equivalent of the Medina, does not appear in this part of Kentucky.

The surface of the county is very generally overlaid by 15 or

20 feet of soils and clays, and exposures of the rocks of the formations only occur on hillsides, bluffs or beds of the streams. On mountain-sides the succession of strata can be observed with comparative ease, as the descent from the summit is quite abrupt, except in the Chester series, where a bench usually occurs, formed by the removal of the shales from above the more resisting limestones, and covered by debris of sandstone, slate, etc., from the overlying Carboniferous.

LOWER SILURIAN.

The exposures of Lower Silurian rocks occur only in the northern and south-western parts of the county, and at the greatest, viz: along the Cumberland river, are only about 80 feet in thickness. The beds comprise about 60 feet of Upper Hudson limestones and 20 feet of an overlying soft, greenish, argillaceous sandstone, designated *Cumberland river sandstone*.

The *Upper Hudson* beds of Orthis limestone in the north-western part of the county have an exposure of about 80 feet along the bluffs that border the Cumberland river, and of about 75 feet at Rowena, further up the river, in Russell county. South from this, on Willis creek, the exposures occur from the mouth, in Cumberland county, to a point only a short distance within this county. The beds of this north-west section are highly fossiliferous, and are apparently horizontal in position.

In the south-west corner of the county another exposure of Upper Hudson occurs along Wolf river for a short distance from the Tennessee State line. The exposure is about 20 feet thick, and dips to the east at about 10° , passing out of sight below the Devonian, whose slates form the bed of the river a short distance east of this locality.

The Upper Silurian is apparently absent from the geologic series in Clinton county, and we find the Devonian resting directly upon the Cumberland sandstone wherever the beds of the latter are exposed.

The *Cumberland sandstone*, so named by Prof. Shaler because peculiar to the Cumberland river region, caps the Upper Hudson series of the Lower Silurian, and in this county is confined to that portion *north* of Poplar Mountain. In the bluffs of Wolf river, near the Tennessee line on the south,

the sandstone does not appear, and the limestones of the Upper Hudson are overlaid directly by the black slate of the Devonian. On the west of the county, above Burksville, on the river, in the adjoining county of Cumberland, its occurrence is alluded to by Prof. Shaler in his report for 1877 (page 30), who considers it to be the equivalent of the Medina sandstone of the New York series. The rock is from 20 to 30 feet thick, is greenish in color, with streaks and markings of much deeper or bluish green color, and is fine-grained in texture. Its bed is apparently horizontal, no dips being observed; no fossils were found.

The sandstone is exposed all along the bluffs that face the Cumberland river in the north-western part of the county, and for some distance along the smaller streams. The highest point on Indian creek, where the stream has cut through the Devonian slate to the sandstone, is just above the mouth of Brown's branch, or a little more than a mile from the Russell county line. In the road just below this point, in its descent from the uplands to the creek valley, the rock is well exposed, and shows a thickness of about 30 feet. The Upper Hudson limestones outcrop immediately under it. On Willis creek the sandstone is exposed from the Cumberland river along the bluffs to the junction of the three forks, and thence in the bed of the stream for nearly a half mile further, when it is hidden by the Devonian slates. Its thickness is here about 25 feet. Elsewhere in the county, southward, it does not appear.

DEVONIAN.

The Devonian is, in this county, represented only by the black slates, the exposures of which are found only along the beds and banks of the Cumberland and its tributaries on the north, and along the Wolf river and Ill Will creek in the south-western part of the county. The thickness of the formation varies in the different portions of the county, being from 25 to 35 feet on the north and from 12 to 15 feet on the south-west. The rock is black and slaty, bituminous and highly pyritous.

On Indian creek, the slates are first exposed from beneath the Waverly, just above the mouth of the East fork, and thence northward they form the bed of the main creek to the mouth

of Brown's branch, where the oil well is situated, and where the creek has worn its way through to the Cumberland sandstone and Lower Silurian limestone, which, in turn, forms the bed to the Cumberland river. The Devonian slate along this creek is about 25 feet thick.

It is again exposed on the north-west along the Cumberland river bluff, and in the streams that empty into the river. Following the road that leads from Orton's Mill down the bluffs of Tear Coat creek, and thence to the river, we find the base of the Devonian black slate at an elevation of about 80 feet above low-water level, and with a thickness of about 35 feet. It outcrops at the bottom of the creek bluff, where a thin bed of bituminous sandstone is exposed; thence to the river the creek flows over Silurian limestones, and in the bluffs that border the river the base of the slates is again exposed immediately over a ledge of the so-called Cumberland sandstone.

On Willis creek, south of this, the Devonian slates appear along the bed for a couple of miles from the county line, or nearly a mile above the junction of the three forks. The beds here have a thickness of only 20 feet, and under them is again seen the Cumberland sandstone.

Throughout the central and south-eastern sections of the county the streams have not cut through the Subcarboniferous, and we find no Devonian exposures. On the south-west, however, the black slates appear in the bluffs bordering Wolf river and Ill Will creek, one of its chief tributaries. On the former stream they are exposed above the Lower Silurian from the Tennessee State line for about a mile, whence they form the bed of the river and base of the bordering bluffs to the crossing of the road just south of Ill Will P. O. They then pass out of sight below the Waverly shales. They have a slight dip to the east. On Ill Will creek the Devonian outcrop reaches from the mouth for about two miles, extending also a short distance along Fanny's creek. The thickness of the bed is only about 15 feet.

SUBCARBONIFEROUS.

This formation, comprising all the strata between the Carboniferous and Devonian, has in this county a thickness of 910 feet.

as shown in the section given above. The two divisions of Upper and Lower are recognized, the former embracing the Chester and St. Louis groups, the latter the Waverly shales and sandstones. The formation covers the entire county area, excepting the summit of Poplar Mountain and a few of its outlying knobs and ridges, and the alluvial valley of the Cumberland and of a few of the streams which have cut through to the formation. The sections below give approximately the strata comprised in the Subcarboniferous, taken in part from the Poplar Mountain exposure at Long's Gap, and in part from that of the bluffs facing Indian creek and the Cumberland valley at Rowena, a short distance north of the county line, in Russell county.

LOWER SUBCARBONIFEROUS.

Immediately beneath the *Lithostrotion canadense* beds which form the base of the Upper Subcarboniferous there is a series of alternating sandstones and crinoidal limestones overlying thick beds of dark shale, intercalated with soft sandstone layers; these comprise the Waverly, or Lower Subcarboniferous division. The entire thickness is about 370 feet, and its various strata are shown in the following section:

LOWER CARBONIFEROUS.—Sandstone, with a seam of coal 218 feet.

UPPER SUB-CARBONIFEROUS.	Chester.	{ Sandstones, shales, green marls and limestones	388 feet.
	St. Louis.	{ Limestones, massive, oolitic and cherty	600 feet.

LOWER SUBCARBONIFEROUS.	Waverly.	Greenish shaly argillaceous fetid sandstone	1 foot.
		Greenish compact sandstone	8 feet.
		Bluish green argillaceous rock, with limestone nodules	2 feet.
		Greenish sandstone, shaly in part	10 feet.
		Blue limestone, with spirifer and productus	8 feet.
		Greenish yellow sandstone	75 feet.
		Thin ledges of crinoidal limestone	5 feet.
		Shale and sandstone in thin layers	65 feet.
		Shale	15 feet.
		Sandstone	1 foot.
		Shale	65 feet.
		Sandstone and thin layers of shale	105 feet.
		Shale separated by one-foot ledges of sandstone	25 feet.

DEVONIAN.—Black slate 30 feet.

LOWER SILURIAN.—Bluish sand-rock and limestones 85 feet.

In the Poplar Mountain section, at Long's Gap, an exposure of the upper beds occurs in part at the foot of the gap, in part at Long's store, or Cartwright P. O., and also at the school-house, a half mile distant down the branch from the store. The strata seen at the former place comprise beneath the Lithostrotion beds the following:

Soft greenish sandstone, argillaceous and plainly bituminous	9 feet.
Bluish green argillaceous sandstone, holding nodules of blue limestone . . .	2 feet.
Greenish sandstone—shaly in part.	10 feet.

At the school-house, which is located on the bank of the branch, the following are exposed:

Grey limestone and Lithostrotion chert.	10 feet.
Greenish sandstone.	1 foot.
Grey and green shale.	10 feet.
Layers of hard massive limestone, with spirifer and productus and minute crinoids, to creek.	8 feet.

A full exposure of the entire series of the Lower Subcarboniferous is well seen at Seventy Six P. O., on Indian creek. The upper part of the bluffs, which recede from the creek, is made up of the lower portion of the St. Louis group. The following is the entire section:

St. Louis.	Soil.	4 feet.
	Greenish grey arenaceous limestone, weathering to a soft yellow sandstone	6 feet.
	Coarsely crystalline bluish crinoidal limestone.	40 feet.
	Coarse blue limestone, holding geodes formed apparently over <i>Lithostrotion canadense</i>	7 feet.
Waverly.	Bluish grey shale in ledges and holding quartz geodes	20 feet.
	A strata of crinoidal limestone, with a layer of dark flint	11 feet.
	Blue shales, with bryozoa and spirifer	9 feet.
	Soft sand-rock, with some flint.	8 ins.
	Shale, with layers of soft bituminous yellow sandstone.	20 feet.
	Blackish shale	125 feet.

The beds seem to be horizontal. The creek here flows over a ledge of sand-rock, which overlies the lowest bed of shale, and then suddenly falls from its narrow bed into a deep and narrow gorge, the water forming a beautiful waterfall, 86 feet high and about 80 feet wide, breaking near the foot into a fine spray, which rises high along the bluffs; thence the creek flows northward, cutting its channel deeper into the Waverly shale, until the Devonian black slate is reached, just above the mouth of East fork. The shale bluffs along the creek are very precipitous, and are ascended with difficulty. The bituminous character of

the sand-rock above the shale is said to be especially noticeable when freshly quarried or broken up, and even at some distance from it. The bed corresponds to that at Cartwright P. O., mentioned elsewhere. The arenaceous limestone at the top of the bluff is heavy bedded, weathers above and below to a soft shaly sandstone, which readily crumbles. It is somewhat fossiliferous—with spirifer and a few crinoid stems. It is also seen east of this in the bluffs of South fork, with a thickness of ten feet, underlaid by four feet of a greenish shaly sand-rock, holding bryozoa, etc., five feet of hard grey crinoidal limestone having stylolite markings, and finally, as exposed, by geode-bearing shales.

Going north from Seventy Six toward Grider's, we find a high broken country, somewhat knobby, and interspersed with deep limesinks. Debris from the Lithostrotion beds covers the country.

The bluffs above Indian creek at Grider's are capped with a greenish sand-rock and covered with cedars. The dark Waverly shale appears at about 90 feet from the top. The following section is exposed here:

Soil	3 feet.
Sand-rock, and covered	90 feet.
Thin ledges of fine blue bituminous limestone and intercalating dark shale	65 feet.
Dark shale	160 feet.
Black slate (Devonian).	15 feet.
Cumberland sandstone.	85 feet.
Fossiliferous limestone, exposed (Lower Silurian).	20 feet

In the eastern part of the county, east of Short Mountain, erosion of the surface has almost extended into the Lower Subcarboniferous beds; for we find Waverly shales in the bed of the creek at the foot of Haw Mountain.

North-west from Snow's Gap the shales and sandstones of the Waverly are seen in the banks and beds of the streams, the uplands being covered with waste from Lithostrotion beds. The country seems to rise to the north-west, and with it the beds of Lower Subcarboniferous, for in the region of Orton's Mill the peculiar geodes, having the forms of *Lithostrotion canadense* are found on the hills about 20 feet below St. Louis chert beds, which cap the high points. At a point one-half mile north of Orton's Mill these geodes are very large and in

great abundance, over a bed of Waverly shales. The latter are much thinner than eastward, the thickness in the bluffs facing Cumberland river being only about 85 feet, overlaid by about 65 feet of crinoidal limestones, and underlaid by 35 feet of Devonian slate. At the head of Tear Coat creek, however, a mile or so eastward, its full thickness of 275 feet appears, also overlaid by 65 feet of limestone.

On the south-west the following section appears in the bluffs facing Willis creek near the salt well. The entire thickness exposed is 350 feet, the shale itself being 235 feet :

SECTION ON WILLIS CREEK NEAR SALT WELL.

St. Louis chert debris on hills.	43 feet.
Lower Subcarboniferous. { Shale, with geodes.	73 feet.
{ Black shale.	80 feet.
{ Decomposing sand-rock	1 foot.
{ Shale	3 feet.
{ Decomposing sand-rock	1 foot.
{ Shale	20 feet.
{ Yellow sand-rock	1 foot.
{ Shale	60 feet.
{ Sand-rock	1 foot.
{ Shale	73 feet.
{ Coarse crinoidal limestone	5 feet.
{ Shale	38 feet.
{ Limestone, with flint	2 feet.
Devonian slate at bottom	25 feet.
Cumberland sandstone.	30 feet.
Silurian limestone.	46 feet.

In the above section the flint appears at the base or immediately over the Devonian black slate. The upper strata appearing in the Ill Will creek sections were not observed here.

East of the Willis creek section the flint strata have not been observed either in the exposures on Indian creek or in the bluffs of the Cumberland at Rowena, in Russell county.

The thin group of soft yellow or greenish sandstones, which form so prominent a feature in the Waverly series of this county, though occupying so small a proportion of the total thickness, is the thin representative of those immense sandstone beds of the north-eastern part of the State, which have a thickness of 600 feet, and are unassociated with shales.

An irregularity in the thickness of the sandstone is apparent even in this county, as shown in the various sections. Its thickest stratum is confined to the upper portion of the beds. At Rowena, near the mouth of Indian creek, the thickness is up-

wards of 75 feet, and at Crider's Mill, on the same creek, near the crossing of the county line, large masses of the rock form isolated points on the brow of the bluff. At the foot of Poplar Mountain a thickness of about 20 feet is shown, the lower portion passing into a shaly rock. On Spring creek, near Jones' Mill, a few miles south of Albany, the sandstone, laminated in structure, forms bluffs 30 feet high above the water's edge. To westward, however, on Ill Will creek, it attains a thickness of 90 feet.

In the southern portion of the county the Lower Subcarboniferous is exposed very generally in the banks and beds of the streams.

In the town of Albany the following section appears in the road-bed on the west leading down to the mill:

Cherty limestone on surface.

Ledge of sand-rock	1 foot.
Shaly micaceous blue limestone inclosing <i>spirifer</i>	15 feet.
Hard blue crystalline limestone, with small crinoids.	2 feet.
Covered to creek.	3 feet.

A short distance down the creek the underlying Waverly shales appear. East from Albany, or just south of Long's Gap, at the head of Smith's creek, the Waverly sandstone is exposed; also still southward, at the crossing of Spring creek, near Savage P. O. The uplands are rolling, and covered with red land from the Lithostrotion beds.

In the western part of the county the Waverly is exposed along the bluffs of Ill Will creek, as well as on its tributaries, from its mouth nearly to its source. At Booker's Mill, northwest from Brown's Cross Roads, the creek flows over the shale, which also forms the bluffs to a height of 150 feet. On the East fork of Ill Will the exposures reach very nearly to Brown's Cross Roads, the sandstone and shale forming bluffs 100 feet high, overlaid by the Lithostrotion beds. At Pickett's store, on the branch just north of the post-office, the stream passes beneath a limestone ledge, and appears on the west side, thus giving to the road a natural bridge.

At the mouth of Ill Will creek the following section is exposed from the St. Louis beds above to the Devonian and Lower Silurian at the foot.

SECTION AT MOUTH OF ILL WILL CREEK.

Top in St. Louis cherty limestone—shaly limestone		13 feet.
Limestone, with <i>spirifer</i> and <i>productus</i>		30 feet.
Lower Subcarboniferous.	Decomposing calcareous sand-rock	95 feet.
	Shaly rock	50 feet.
	Greenish sandstone and quartz geodes	40 feet.
	Green shale	13 feet.
	Crinoidal limestone, with black flint and siliceous crinoid stems	25 feet.
	Green shale	30 feet.
	Leached flinty crinoidal mass	1 foot.
	Green shale	3 feet.
	Ledge of flint	2 inches
	Bright green shale	15 feet.
Devonian black shale		15 feet.
Lower Silurian limestones (dipping south-east)		20 feet.
		350 feet.

The above section shows an entire thickness of 350 feet, or about the same as at Poplar Mountain and northward, near the Cumberland river.

UPPER SUBCARBONIFEROUS.

This division covers the greater part of the county, outcropping on the sides of Poplar Mountain, its outliers and knobs, and extending over the lower plains southward to the Tennessee State line, and northward nearly to the Cumberland river. Its subdivisions, however, are more limited, the upper being removed by general erosion from all but the highest points.

The following section from Poplar Mountain, exposed at Long's Gap, shows the character of the strata:

SECTION FROM POPLAR MOUNTAIN AT LONG'S GAP.

UPPER SUBCARBONIFEROUS.	CARBONIFEROUS	{ Conglomerate and sandstones, with a seams of coal		213 feet.
		{ Shaly slate or sandstone		60 feet.
	Chester.	{ Green marl		100 feet.
		{ Shales, with quartz geodes		30 feet.
		{ Dark limestone, with calcareous concretions		18 feet.
		{ Magnesian limestone, slightly crinoidal; holding concretions and geodes		40 feet.
		{ Impure coarsely crystalline laminated limestone		5 feet.
		{ Dark coarsely crystalline crumbly limestone		10 feet.
		{ Greenish shaly sandstone		25 feet.
	St. Louis.	{ Massive limestone		50 feet.
		{ Ledges of grey limestone, with some crinoidal stems and pentremites		95 feet.
		{ Argillaceous limestone		3 feet.
		{ Arenaceous dark limestone		4 feet.
		{ Fine-grained dark bluish limestone		4 feet.
		{ Semi-oolitic limestone		2 feet.
		{ Massive grey limestone		2 feet.
		{ Hard gray oolitic limestone		4 feet.
		{ Limestone, with chert and <i>Lithostrotion canadense</i>		140 feet.

ST. LOUIS GROUP.—Overlying the Waverly or Lower Subcarboniferous series, there are about 140 feet of cherty limestones holding the characteristic fossil, *Lithostrotion canadense*, of the St. Louis. Above these are eight feet of oolitic limestones—which, in the north-western part of the State, assume a great thickness—and 145 feet of light limestones, which are in part crinoidal. These comprise the St. Louis group, with an entire thickness of a little less than 300 feet. The greater portion of the series is confined to the mountains or elevations above the general level of the country, at whose bases the Lithostrotion beds are exposed. The debris from these beds covers the greater part of the surface of the country, giving to the soil a reddish ferruginous character, while in the bluffs along the streams are exposed the strata of Lower Subcarboniferous.

The base of the series, formed of Lithostrotion limestones, is exposed at Long's Gap, as shown in the above section, and overlies the upper beds of the Waverly series, which make up the Lower Subcarboniferous. Passing northward from the mountain it is again seen at Long's school-house, not far from the foot of the gap; the Waverly greenish sand-rock and shale outcrop beneath it, as shown in the following section:

Grey limestone, with <i>Lithostrotion canadense</i>	10 feet.
Greenish sandstone.	1 foot.
Green and greyish shale	10 feet.
Ledges of hard massive limestone	8 feet.

Going northward we find the uplands to be covered with more or less of red clay and debris of Lithostrotion beds, while in the bluffs or sides of hills the limestone is often seen in outcrops of several feet thickness overlying the sand-rock. Thus, on the east fork of Indian creek, a couple of miles below Long's store, there appears in the road on the hill-side a hard limestone holding numerous spirifer. At Seventy Six P. O., near the junction of the branch with the main creek, the following section is exposed above the Waverly beds:

Soil of the hills.	4 feet.
Greenish grey siliceous limestone, weathering to a soft yellow sandstone . .	6 feet.
Coarsely crystalline blue limestone, crinoidal in part.	40 feet.
Coarsely crystalline blue limestone, holding <i>Lithostrotion</i> geodes	7 feet.
Waverly beds	125 feet.

Limesinks are a prominent feature of the uplands, north of Seventy Six P. O. Westward the Lithostrotion debris is frequently exposed on the road leading from Snow's Gap northwest to Ortens, in beds 10 feet or more thick, and accompanied by limestone. Again, in the broken country at Ortens, the St. Louis limestone caps the hills, while at 20 feet below it the geode-bearing rocks of the Subcarboniferous appear on the hill-sides. The section is well exposed in the bluffs facing the Cumberland river, and also at the head of Tear Coat creek. The bluffs are about 290 feet in height above the river, the upper 65 of which is made up of ledges of crinoidal limestone, but rise eastward into the St. Louis beds.

In the eastern part of the county the same feature is observed as on the west; and on the high dividing ridge that runs north from Cumberland city towards Rowena the surface is underlaid by St. Louis Lithostrotion limestone.

Short Mountain, a north offshoot from the Poplar range, rises nearly as high as the latter, and its sides present about the same outcropping of the Carboniferous, Chester and St. Louis series as already given, the latter comprising about 285 or 300 feet.

Haw Mountain is about 375 feet in elevation above the branch at its foot, in which the Lower Subcarboniferous rocks appear. From the branch to the top of the chert debris there is an elevation of about 120 feet; above this the middle and upper St. Louis limestone beds outcrop for 200 or more feet, the Chester sandstone debris covering the mountain top, and affording scarcely any opportunity for examination of underlying strata.

The general surface of that part of the county south from the central Poplar Mountain range is, as on the north, underlaid by the lowest beds of the Upper Subcarboniferous, through which the many streams have cut their way and exposed the lower division of the formation. The lands are themselves generally reddish from decayed chert and Lithostrotion beds. Near the mountains on the east, where the streams have their source, and have not cut deeply into the strata, only the St. Louis rocks are seen, but as we go westward the lower beds are cut more and more deeply,

until in the south-west corner of the county the Devonian and Lower Silurian rocks are exposed by the streams.

Near the mountains, in the central part of the county, the general erosion of the country has been greater, and the streams expose the strata below the St. Louis near the foot of the range. Thus at Albany, two miles south of Snow's Gap, the surface is underlaid by but a few feet of the cherty limestone of the St. Louis.

On the west of the mountain, at Brown's Cross Roads, while the Lithostrotion waste covers the country, Thrasher's branch has cut a deep channel near the mountain and enters a lime-sink, and thence, by an underground passage, flows under Pickett's store, and emerges in a gorge 75 feet below the surface of the uplands. In the sides of this gorge, the upper beds of the Lower Subcarboniferous are exposed.

The tops of the hills along Ill Will creek are covered with chert waste, as are also the uplands along Wolf river in the south-western part of the county. Near the latter the rocks are cavernous, a large cave occurring near the State line. Going down Spring creek from its source in the eastern part of the county, the first outcrops of the Lower Subcarboniferous sandstone were observed at the crossing near Savage P. O., and also near Jones' Mill, south-east of Albany. On Lick creek, in the south-eastern corner of the county, the same sand-rock is observed near the Tennessee line.

The outlying knobs and offshoots of the Poplar Mountain range along the eastern border of the county, as well as the abrupt sides of that range, present outcrops of nearly the entire series of Upper Subcarboniferous from the coal measures down to the lower beds. In no place, however, are the strata so well exposed in all their detail as at Long's Gap, as given above.

The following is a section of Davis' Knob, just south of the road leading from Albany to Monticello; the strata were largely hidden by debris of Chester sandstone:

Coal measures	165 feet.
Chester series.	60 feet.
St. Louis limestone, the lower part grey, massive and cherty	545 feet.
Shaly limestone to bed of creek	25 feet.

Copperas Knob, near this, Oak Mountain and other knobs to southward, all embrace the entire series of Upper Subcarboniferous strata, their tops being barely covered with the Carboniferous sandstone.

CHESTER GROUP.—The upper beds of the Subcarboniferous comprise approximately 130 feet of green shaly marl, and about 75 feet of impure dark limestones, with 25 feet of sandstone. The group corresponds in position and character to the Chester of the Illinois report, but is very much thinner, and differs in the series of strata. The green marl, which here is the uppermost of these beds, is a shaly argillaceous material, which readily disintegrates into a soft plastic mass. It is exposed only along the sides of Poplar Mountain and its outliers, and lies immediately below the Carboniferous shaly sand-rock, usually forming a shelf along the mountain-side, covering and protecting from erosion the underlying limestone.

Immediately to the west of Long's Gap there is a prominent and small peak, known as Jack Mountain, whose summit rises above the Chester; but immediately westward for one-fourth of a mile, to the next high point, there is a trough in which the green shaly marls are well exposed. An old field and orchard, long since thrown out of cultivation, now occupies the narrow surface of this trough.

On other points in the Poplar Mountain range the overlying Carboniferous sandstone in broken fragments on the mountain-side hides from view the green marl, except on the east side of Sewell's Gap, where it outcrops at an elevation of about 350 feet above the gap. Its thickness here was not ascertained.

In the several offshoots or outliers of the mountain the marl is not prominently exposed. The sandstone forms the summit rock on the south side of Short Mountain Gap, and also of Haw Mountain to the north-east of the gap.

The limestone strata of the Chester are dark, inclined to crumble, and mostly devoid of fossils, excepting some crinoids, so far as an examination revealed. The upper or archimedes limestone of the Illinois series seems to be entirely absent, and we have here only the lower representatives, from the Big Clifty sandstone up.

CARBONIFEROUS.

The Poplar Mountain range is the extreme western limit of the Cumberland Mountains within Kentucky, and carries with it also the most westerly occurrence of the Carboniferous beds of the eastern coal field of the State.

The highest crest of the mountain forms the southern half of the eastern border of the county from the Tennessee State line northward; the range then bends abruptly to the west, its summit being unbroken for the first four miles; but thence to the center of the county it is broken up into isolated but still prominent ridges and points, separated by narrow but deep gaps; other isolated points and ridges occur north and south.

The mountain proper and the highest of these isolated knobs and ridges are capped with the sandstone and shales of the Lower Carboniferous, or so-called false coal measures. Upon the lower elevations, embracing the western half of Sewell's Mountain, and all of that west of Snow's Gap, these beds have been removed and the Upper Subcarboniferous rocks form the uppermost strata.

The Carboniferous formation, therefore, covers but a small area within the county—not exceeding five square miles—and only upon Poplar Mountain and the highest of its outliers. This, in detail, embraces that narrow portion of the mountain along the eastern county line; the broad area between the county line and Long's Gap; the very small knob called Black Jack, immediately west of the gap; the eastern portion of Sewell's Mountain, lying a little westward; Short Mountain, an outlier on the north of the Poplar Range; Davis and other knobs on the south. The summit of these various knobs and ridges vary but little in elevation from that of Poplar Mountain, and we find very nearly the same strata in the vertical section of each.

As already stated, only the Lower Carboniferous, or false coal measures, is represented in Poplar Mountain. A heavy ledge of hard sand-rock forms usually the topmost stratum, with a thickness of from 20 to 35 feet.

It is underlaid by a soft micaceous sandstone, which usually holds a bed of coal, varying from a few inches to 3 or 4 feet in thickness.

The following section is exposed at Long's Gap to the east of the road :

Carboniferous.	Soil and covered material.	20 feet.
	Massive and hard sand-rock.	30 feet.
	Micaceous sandstone	42 feet.
	Coal bed and fire-clay	3 feet.
	Soft shaly sandstone, with leaf markings, and another bed of coal.	140 feet.
	Sandstone	60 feet.

It is more than probable that much of the covered surface material comprises the sand-rock masses, as in other places in the mountain crest its thickness is as much as 35 feet. The rock is hard, massive and not readily broken. Upon the main ridge it forms a regular ledge, often presenting a bold face to the lower plains, and its summit also gives a very even character to the surface of the mountain. Upon Sewell's Mountain, to the west of Long's Gap, it is again seen, and very prominently, both on the south and north crests. At Prospect Rock, noted because of the extensive view to southward which it commands, the rock is about 35 feet thick, and its summit about 640 feet above the town of Albany. It forms an abrupt face for a long distance along the brow of the mountain. Below the sand-rock every thing is covered by debris of micaceous sand-rock to the shelf of Subcarboniferous limestone.

On the opposite or north crest of the mountain the sandstone again presents a bold face to the plains lying 600 feet below, and from its summit extensive views can be had over the northern half of the county.

On Short Mountain, an outlier on the north, and having a north and south trend, the rock is not as thick, and is much broken up into large fragments, which still remain almost in place. This mountain has a lower elevation than the main Popular range. Beneath the sand-rock masses of micaceous sandstone cover the sides of the hill down to the coal bed, which lies about 185 feet below the top of the hill. This coal bed is lower in the series than at Long's, and has a thickness of from 22 to 48 inches, and has at one time been extensively mined. The mountain is narrow, and the tunnels pass through it from east to west. It is said that a thin vein underlies this at a few feet.

The coal was transported by rail to Cumberland river, and

thence by barges to Nashville, Tennessee, and commanded fair prices.

The following is a section of the strata of the mountain from Cumberland City to the summit:

SECTION AT CUMBERLAND CITY.

Carboniferous.	Soft sandstone, not clearly seen.	70 feet.
	Massive hard sandstone	5 feet.
	Soft shaly sandstone.	150 feet.
	Coal bed averaging	40 ins.
	Shales and thin sandstone	40 feet.
Chester.	Greenish marls	30 feet.
	Shaly sandstone and thin limestones }	
	Limestones and shales.	20 feet.
St. Louis.	Limestones, generally massive, above Cumberland City.	210 feet.

The coal is lower in the series than that of Poplar Mountain.

On the knob south of Poplar Mountain, in which Davis' coal bank has been opened, the sand-rock again appears in a broken ledge on the summit. The thickness of the Carboniferous here is about 175 feet. The coal bed occupies a position about 160 feet below the summit, and has an irregular thickness of from 3 to 3.8 feet. It is said to be badly broken in the vein. The mountain or knob is short and narrow, with a trend nearly north and south.

Oak Mountain, on the south, is highest nearest the eastern Poplar Mountain range, and only upon this high portion do we find any Carboniferous strata. Copperas Knob is capped by but a few feet of the micaceous sandstone of the Carboniferous; no coal appears. Jenney Knob and the longer ridge near the Tennessee State line are made up of Subcarboniferous rocks.

ALLUVIUM.

The alluvial area is very small, and occurs exclusively along the Cumberland river and its tributaries in the northern part of the county, its limit up the latter streams being defined by that of the back-water from the Cumberland. The materials of which the alluvium is composed are the fine sands and dark

clays brought down in suspension by the river current and deposited where that buoyant force is sufficiently checked. We thus find that along the immediate banks of the river the sediment is more or less sandy in character, while back from the river along the tributaries the quiet back-water permits the deposition of the finer sands and some flocculated clay.

In this county the Cumberland river border is limited to a small bend on the north-west, which forms a pan-handle strip of land. On the eastern side of this strip the river washes the base of the bluffs, leaving no valley; while on the north and west the current has slowly cut away the bluffs to westward, leaving a valley from one-fourth to one half mile in width, covered to a depth of 10 or 15 feet with an alluvial deposit.

The entrance of Wells and Tear Coat creek bottoms has enlarged the extent of this alluvial area, back-water reaching for about one half mile up each stream.

On Indian and Willis creeks the county line crosses at points which also about mark the limit of the alluvium.

ECONOMIC FEATURES.

The chief features of the county, from an economic point of view, are its lands and timbers, described elsewhere, its coal beds, gas and oil wells, marls and marly clays. There is a little iron in the county, but not in paying quantities, and is not included in the special descriptions.

COAL.—The coal area of the county is confined to the following mountain summits: The Poplar Mountain range from the county line westward to Long's Gap; that portion of the Sewell Mountain lying still westward nearly to Snow's Gap north of Albany; Short Mountain (north of Poplar Mountain) nearly to Cumberland City; and Copperas Knob, south of Poplar Mountain. The total area is only about five square miles, and lies chiefly on Poplar Mountain between Long's Gap and the county line. The series belong to the lower coal measures (sometimes called "false coal measures"), which extend southward into Tennessee. Two beds of coal are sometimes exposed, each varying in thickness from 24 to 48 inches, an irregularity produced by the undulating roof of micaceous sandstone.

The upper lies from 30 to 40 feet below the massive sand-rock, and more than one hundred above the Chester beds; the lower from 30 to 40 feet above the Chester. This latter in Poplar Mountain appears to be but a few inches in thickness, so far as exposed.

The most extensive mining has been done on Short Mountain, near Cumberland City, a narrow-gauge track for coal cars having been laid from the mines to Cumberland City; thence down a branch to the bed of Indian creek, and thence to Cumberland river, a total distance of $7\frac{1}{2}$ miles. At the mouth of Indian creek the coal was loaded on barges and taken to Nashville. The coal in this bed has a thickness of from 22 to 48 inches. The tunneling was extensive, and passed through the mountain from east to west—a distance, however, not very great. Operations ceased in 1878, and the mine abandoned.

The following analysis shows the composition of an average sample of coal:

No. 1742.—Coal from Cumberland mines in Short Mountain; a pure-looking, pitch-black coal, with very little fibrous coal or pyrites. Specific gravity 1.329.

COMPOSITION (Air Dried).	
Hygroscopic moisture	1.56
Volatile combustible matter	37.74
Coke	60.70
otal.	100.00
Total volatile matters	39.30
Carbon in the coke	50.20
Ash	10.50
Total.	100.00
Percentage of sulphur	2.911

The coke is light spongy; the ash is light lilac-grey in color.

In the Poplar Mountain beds two or three mines have been opened, and some coal taken out, but no shipments made. Long's bank, situated on the brow of the mountain, a little east of south of Cartwright P. O., or Long's store, lies 35 feet below the massive sandstone, which has here a thickness of 30 feet. The top is said to be 1,678 feet above tide water. The coal has a thickness of from 28 to 42 inches, with a roofing of micaceous sand-rock undulating and producing "horsebacks" in the coal bed.

Pitman's bank, the property of Mrs. Mary Pitman, is a mile or more east of Long's, also on the north side of the mountain, and is very similar in character and thickness to that of Long's. It was opened some 35 or 40 years ago, and a tunnel made to about 50 feet. Another opening was at the same time made about 200 yards west of this, and a longer tunnel worked out. A grey fire-clay underlies the coal.

Davis' coal bank is the only one at present utilized and the coal placed in market. It is located on the Davis' Knob, south of the Poplar Mountain central range, or west of the same range that forms the eastern boundary line of the county. The bed is about 150 feet below the summit of the knob, which is small in area, short and narrow. The bed here also varies from 24 to 44 inches in thickness, and is "badly broken in the vein." It is quite pyritous, but has a ready market in Albany at about ten cents per bushel.

The adjoining Copperas Knob has a cap of Carboniferous micaceous sand-rock, but the summit is beneath the coal bed.

On the south side of Poplar Mountain another coal bed has been opened up by Mr. L. W. Duvall, near the county line.

OIL AND GAS WELLS.

There is but little to be said in regard to the presence of either of these substances within Clinton county. Flowing oil wells have been opened up in the adjoining county of Cumberland, and are said to have yielded daily from 40 to 50 barrels of oil, having a specific gravity of from $22\frac{1}{2}$ to 35. They were sunk to a depth of from 200 to 300 feet into the Lower Silurian beds.

The first borings were made more than 70 years ago, the object being to obtain salt water. The value of natural gas and oil was then not recognized, and the presence of these products were regarded as nuisances or objects of curiosity, and they were allowed to escape.

The western part of the county embraces a part of the eastern slope of an uplift or anticlinal that lies to westward, and which marks the region in which oil and gas may confidently be searched for by borings. This uplift brought nearly to the surface the Upper Hudson limestones, which, in the bluffs of

Wolf river on the south-west, have a strong dip to the south-east, and on the north-west along the Cumberland seem to be nearly horizontal.

The localities in this county, where borings have been made, are as follows: On Captain Hurt's land, in the south bend of Wolf river, in extreme south-west corner of the county; on Fanny's creek, a short distance north of the mouth, on the place of Mr. Craft; on Willis and Salt Lick creeks, in the north-western part of the county; on Indian creek, at the mouth of Laurel branch. In the adjoining county of Cumberland more extensive and very successful borings have been made.

The well on Captain Hurt's place, on Wolf river, was bored for salt, about 70 years ago, to a depth of about 100 feet. Gas is said to have escaped in large volume, which being ignited, produced a blaze 20 feet high. A little oil seeped into the well just before reaching the salt water. Neither the oil or salt was in sufficient amounts to justify the continuance of the boring. The boring was begun about 25 feet below the top of the Upper Hudson beds. On Craft's place, in the valley of Fanny's creek, a short distance north from Hurt's, a well was bored in 1865 or 1866 to a depth of about 250 feet, beginning in the Devonian black slate. A little oil in seeps was found, but no salt was reached. The depth penetrated in these two wells would probably not pass through the Upper Hudson or Nashville beds.

In the valley of Willis creek, in the north-western part of the county, two wells were bored for salt in 1866 near the county line. Both were sunk to a depth of about 175 feet, and from the lower one, salt was made in large amounts. Some gas is said to have been reached while boring. The salt water in the upper well was tainted with sulphur. These are now abandoned.

On Salt Lick creek Gabbert's well is located on or near the county line, and has yielded some oil. Work has recently been done there by Capt. John Adams.

The valley of Indian creek also exposes the Lower Silurian and Devonian beds as far south as Laurel branch and beyond; and in this branch, near its junction with Indian creek, a well was bored many years ago to quite a depth. Some salt water and gas were found, but no oil.

MARLS.

The shales of the Chester group, outcropping in the upper portion of the mountain-sides, are often found weathered or disintegrated into a soft, tenaceous, greenish marl or marly clay, many feet in thickness. Exposures are seen at many points below the brow of the mountain, above the terraces, as far west as Snow's Gap.

From an economic point of view, the marl is of value, not only as a fertilizer, but in the manufacture of a good cement, resembling as it does the well-known marl of Leitchfield, Grayson county, from which much excellent cement has been made by a special process.

The following analysis of a sample taken from the beds near Cumberland City was made by Dr. Peter :

No. 1741.—*Marly Clay*, from Cumberland City mines (Leitchfield marls); a dull, olive-grey, indurated marly clay.

COMPOSITION OF CHESTER MARL.

Silica	70.800
Alumina, with a little iron, manganese oxides and phosphoric acid	18.840
Lime	.594
Magnesia	4.358
Potash	4.240
Soda	.794
	99.626

“The phosphoric acid was not determined, but similar marls from Grayson and other counties are found to contain from one-tenth to as much as one per cent.”

The large percentage of potash in this marl makes it of special value as a fertilizer on lands deficient in that element of plant-food. The potash is mostly in a condition from which the plants can but very slowly assimilate it, or from which it can be but slowly released by weathering, if spread on lands ; and hence some treatment by which it may be rendered available as plant-food is highly desirable, if applied to soils greatly deficient in potash. Dr. Peter, the chemist of the Survey, recommends several methods which may prove successful.

“Exposed to the atmospheric agencies, the insoluble silicates of potash undergo a gradual decomposition, and their valuable ingredients are thus set free for the use of plants. The decom-

posing remains of vegetables accelerate this process, and hence the great propriety of using these marls together with stable manure or other organic fertilizers, or of employing a clover or other green crop, plowed in, as a means of disintegrating the silicates. Doubtless, poor exhausted land, which had been top-dressed with the marl, and then sowed in clover, which, after the growth of one or two seasons was plowed in, would be found to be greatly improved in fertility." * * * "A quicker method of setting free the alkalies, etc., of these marls would necessarily be more expensive. Heating to a moderate heat the mixture of finely-ground marl with a large proportion of pulverized carbonate of lime and about an equal proportion of sal ammoniac (ammonium chloride), is quite effectual in separating all the alkalies of the insoluble silicates; but it is somewhat expensive on the large scale. The mere mixture of slacked lime with the powdered marl, when applied to the lands, would doubtless be beneficial in accelerating its decomposition, and calcining them together at a moderate red heat might be yet more useful, especially if a little common salt be added." *

MINERAL SPRING.

On the side of Sewell's Mountain, near Albany Rock, a spring gushes from beneath the massive Carboniferous sand-rock; its temperature was 52° F. The rock at this point is fifty feet thick. The spring is chalybeate in character, and during the summer months quite attractive to parties who have climbed the mountain to enjoy the splendid views from Albany Rock.

An analysis of a sample of the water by Dr. Peter gave the following result:

COMPOSITION IN 1000 PARTS OF THE WATER.

Iron carbonate	0.320	} Held in solution by carbonic acid.
Lime carbonate	.011	
Magnesia carbonate	.021	
Silica	.020	
Potash and soda in minute quantity—not estimated.		

Total saline matters in 1000 parts of the water . . .	<u>0.372</u>
---	--------------

"A weak saline chalybeate water; not less valuable because it is weak."

* Kentucky Geological Survey, New Series, Vol. 4, pp. 72-74.

AGRICULTURAL FEATURES.

The character of the surface of the county, upon which depends its agricultural features, has already been described as that of a plain, reaching from the Tennessee State line northward, bordered on the south-east by the Poplar Mountains, and interrupted in the central part by the westerly extension of that range half way across the county, and also by numerous prongs and knobs of the same along the eastern side of the county.

The lands of the county may naturally be classified in the following regions :

Mountain table lands.

Mountain terraces.

Mountain slopes.

Lower uplands or plains.

Creek bottoms.

River bottom or valley.

These regions were originally covered with a timber growth ; the mountains are still largely timbered, but on the plains, which comprises almost entirely the farming portion of the county, this has been largely cut away. This is especially the case in that portion south of the central mountain range. The chief products of the county are corn, wheat and tobacco ; apples are also produced in great abundance ; cotton is cultivated in small patches, but unless manured and its maturity hastened, does not yield well. With manure its average yield has been estimated at 1,200 pounds of seed-cotton per acre. There is a cotton-gin in Albany. Corn gives an average yield of from 15 to 30 bushels per acre, and wheat about 9 bushels.

The experience of Capt. Hurt with two acres of hill-side land that had been under cultivation for 60 years shows the capabilities of the soils of the county when properly and intelligently cared for. The land was broken up in the spring, the grass turned under and the cattle allowed to tread it. During the summer it was plowed occasionally, then manured, and planted in September with wheat. This gave a yield the next year of 46½ bushels of wheat per acre.

At another time he sowed it with grass, allowed cattle to graze

on it for a year, and then planted it in corn, obtaining a yield of 60 bushels per acre.

Tobacco, on the uplands, yields about 600 pounds of very good quality; on the bottom lands, while the yield is about 1,000 pounds per acre, the leaf is coarse and heavy. Apple orchards are very numerous, and a good yield is obtained. Several varieties are planted, but the Jenet and Limber Twig seem to be the favorites, both making good brandy. The Jenet is juicy and tender, and keeps well; but the Limber Twig is sweeter, keeps better, and is preferred for drying. The Ben Davis—so popular in other counties—has but recently been introduced here. According to the census of 1880, the number of farms in the county was 960, and the cultivated area 48,374 acres, or about 37 per cent. of the entire surface of the county. The products of the county in that year were 281,808 bushels of corn, 10,115 of oats, 33,375 of wheat, and 77,408 pounds of tobacco.

MOUNTAIN REGION.

This division is within Clinton county, of comparatively small extent, being confined to the central range of mountains and to their outlying knobs north and south. The division embraces the following agricultural subdivisions:

Sandy lands of mountain summits or table-land.

Clayey lands of mountain terraces.

Limestone lands of mountain slopes.

Each of these has its own peculiar agricultural features, based chiefly upon the accompanying geological or lithological features, and will be separately described.

MOUNTAIN TABLE-LANDS.

The western brow of the Poplar Mountain forms the county line on the east for many miles northward from the Tennessee State line, and the only table-lands embraced within the county are, therefore, upon that portion of the mountain that bends to the westward and reaches half through the county.

The summit of the latter is very irregular in its widths, because of the sharp and abrupt offshoots and incurves of the brow of the mountain. At the county line, on the east, it has been nearly

cut through, the width being a little more than an eighth of a mile, but it suddenly widens out to more than a mile, and to westward is cut in two by Long's Gap. West of the gap it forms a sharp point on Jack Knob; falls to a lower elevation, and on Sewell's Mountain, still westward, it forms another broad table-land of irregular outline. Snow's Gap separates this from the lower mountain on the west, which trends north and south for a mile or more, with a width of from one-fourth to one-half a mile. This latter mountain is the most westerly of the range, and lies a little west of the central part of the county, or north-west of Albany, the county seat. On the north of the Poplar range lies Short Mountain, which has a narrow summit, affording but little area for agricultural purposes; and the same may be said of the knobs and larger outliers of the main range north and south.

The table-lands of the Poplar Mountain are made up of, or overlies for the most part, a massive Carboniferous sandstone, and the soils are chiefly derived from its disintegration. There is, therefore, a thick deposit of sandy soil and subsoil, bearing a timber growth of chestnut, chestnut oak, poplar, white oak, some hickory, post oak, sour wood, dogwood, and some black and sweet gum and buckeye. Laurel also forms a dense undergrowth in places. There is very little, if any, of the land under cultivation. The soil of Sewell's Mountain has a yellowish color.

The following soils, the one taken from the mountain summit, the other from Caney gap, which, though resting on St. Louis limestone, is made up of sand debris from the mountain, have been analyzed for the Survey. The results of both the mechanical and the chemical analyses are given below:

No. 2860. *Mountain sandy soil.* Sewell's Mountain of the Poplar Mountain range. Near Cartwright P. O., Clinton county. Forest growth: chestnut, chestnut oak, black gum, some red and white oaks. Sample taken to the depth of ten inches. Geological position: on lower coal measures.

Soil is of a light buff-grey color; some friable clods. All passed through the coarse sieve, except one or two small fragments of ferruginous sandstone or concretions. Its silicious residue all passed through the fine sieve, except about 8.3 per cent. of fine white sand.

No. 222. *Soil* from Mr. Andrew's place, Caney Gap; large timber growth of red and white oaks, chestnut, hickory, beech and poplar. The subsoil is red. The color of the dried soil is a warm grey. Washed with water, it gave more than 51 per cent. of fine sand, of a dirty buff color, containing about 12 per cent. of coarser sand like common bar sand. One thousand grains of the air-dried soil, digested in the carbonated water, gave up less than a grain and a-half of solid extract of a brownish color, dried at 212°. The air-dried soil lost 1.96 per cent. of moisture at 400° F.

The mountain soil, air-dried and examined for its mechanical constituents of sands of various degrees of fineness, and for silt and clay, gave the following results :

MECHANICAL ANALYSIS OF SEWELL MOUNTAIN SOIL No. 2860.

Gravel and rock fragments, diameter above 1. mm	2.361
Coarse sand, diameter from 1. to .5 mm.	1.362
Medium sand, diameter from .5 to .25 mm.	6.147
Fine sand, diameter from .25 to .1 mm.	16.509
Finest sand, diameter from .1 to .05 mm.	30.122
Silt and dust, diameter from .05 to .01 mm.	40.708
Clay dust, less than .01 mm.	2.490
	99.699

NOTE.—A millimeter is 0.0394 inches.

The sand in the above, after separation from the silt and clay, is white and clear, with sharp edges. Its large percentage (56.5) gives to this soil a rather loose character, though the greater proportion is of so fine a nature. The percentage of silt and clay, which give to the soil its tenacity, is 43.2.

The following tables give the chemical constituents of the above soils :

SANDY LAND OF POPLAR MOUNTAIN SUMMIT.

DRIED AT 212° F.	Sewell's Mt.	Caney Gap.
	Virgin Soil.	Soil.
	No. 2860.	No. 222.
Organic and volatile matters	2.985	3.970
Alumina, iron and manganese oxides	4.243	4.318
Lime carbonate	.151	.076
Magnesia	.145	.131
Phosphoric acid	.097	.090
Potash	.351	.085
Soda	.317	.099
Water expelled at 400° F.	.514	.196
Sand and insoluble silicates	90.784	90.720
Total	99.587	99.575
Moisture expelled at 212° F.	0.705	1.96
Potash in siliceous residue	.417	

The above soils are in some respects closely similar. Unfortunately, the depth to which No. 222 was taken is not given ; but it must have been much less than the other sample, for there is a larger percentage of vegetable matter, and much smaller of other important substances present, while the amounts of sand and of iron, etc., are about the same in each. The soil of the gap is very poor in lime and potash, while the percentage of phosphoric acid is also rather low. Taking No. 2860 as an analysis of a typical specimen of a sandy mountain soil, we find a small per cent. of lime and magnesia, and also of phosphoric acid. The amounts of potash and soda are surprisingly large ; and, were other conditions favorable, such as depth, etc., they clearly indicate the value of these lands for grape culture.

The amount of potash in the insoluble condition is also large, and indicates durability in the supply of that element of plant food.

TERRACE LANDS.

There are frequently seen, along the sides of the mountains, narrow bench lands or terraces standing out and resting upon the heavy beds of Subcarboniferous limestones at a high elevation above the plain. They were formed by the removal of the soft shaly material of the Chester formation (which also produced the falling of the sandstone from above), and have a width sometimes sufficient for small tillable fields.

There are also certain ridges, connecting the mountains and their knobs, whose summits have been worn off until these Chester shales were exposed, and upon these we usually find larger areas of cultivable lands. Such a ridge connects Sewell's Mountain with Black Jack knob, just westward of Long's Gap, and upon it is an old field long ago thrown out of cultivation. Such areas of arable land are not very numerous, and it is only the richness of their soil that makes them worthy of mention.

A green marl is derived from the disintegration of the shale, and is rich in the elements of plant food, as the following analysis of a sample (derived from these shales) will show :

ANALYSIS OF CHESTER MARL.

Silica	10.800
Alumina, a little iron and manganese oxides and phosphoric acid	18.840
Lime	.594
Magnesia	4.358
Potash	4.240
Soda	.794
	99.626

Similar marls from Grayson county contain from one-tenth to one per cent. of phosphoric acid. This, with the very large amount of potash, makes the marl of especial value as a fertilizer. From the marl the soil is formed by the admixture of sand from the upper beds of Carboniferous sandstone, and by that of decayed vegetation, which improves its mechanical condition. The subsoil is usually heavy and plastic ; and unless the soil be very deep, the conditions are not favorable for productiveness. Specimens taken for examination from near Long's Gap were lost ; but it is believed that the analyses given below of samples taken from Copperas Knob, south of the mountain, will give a fair average of these lands :

No. 2109. *Virgin soil*, from the farm of Lewis Huff, at the north end of Copperas Knob, at Huff's coal bank, one mile east from the Livingston road. Geological position, on the first terrace above the Subcarboniferous limestone, and the second below the coal, and on the steep terrace slopes of the coal-bearing sandstone and shales.

The dried soil is friable, and of a dark umber grey color; contains 22.4 per cent. of irregular, slightly rounded fragments; some pretty large pieces of ferruginous sandstone or silico-ferruginous concretions.

No. 2110. *Cultivated soil*, from the same field as No. 2109; had been in cultivation six years in corn. The dried soil resembles the preceding; contains 27 per cent. of ferruginous, siliceous fragments, not rounded; some large.

No. 2111. *Subsoil* of the next preceding, but is slightly darker in color; contains 14.2 per cent. of irregular fragments of ferruginous sandstone, not much rounded, and a few small rounded quartz pebbles.

TERRACE LANDS ON COPPERAS KNOB.

(Chester Geological Formation.)

DRIED AT 212° F.	Virgin Soil.	Cultivated Soil.	Subsoil.
	No. 2109.	No. 2110.	No. 2111.
Organic and volatile matter	6.615	9.275	6.910
Alumina, and iron and manganese oxides. .	5.984	6.687	6.951
Lime carbonate	.405	.620	.480
Magnesia	.232	.232	.223
Phosphoric acid	.166	.173	.259
Potash	.212	.274	.222
Soda	not est.	not est.	not est.
Water expelled at 380°	1.400	1.810	1.665
Sand and insoluble silicates	84.990	81.165	83.365
Total	100.004	100.236	100.075
Hygroscopic moisture	1.585	1.990	1.750
Potash in insoluble residue	.983	.098	.972
Soda in insoluble residue	.217	.101	.158
Percentage of gravel	22.400	27.000	14.200

The analysis of the virgin or uncultivated soil shows the presence of fair percentages of potash and phosphoric acid, as

well as of lime, while that remaining in an unavailable condition in the insoluble silicates is very large. The subsoil also is very rich in these elements of plant food, their percentages being larger than in the soil. In fact, the subsoil seems to be largely derived from the shale.

By cultivation the soil has gained in percentages of available potash and phosphoric acid, but at the expense of that contained in the insoluble silicates, having apparently lost altogether as much as .813 per cent. of potash. The action of the lime in breaking up the insoluble compounds is here clearly shown.

MOUNTAIN LIMESTONE OR HILL-SIDE LANDS.

A prominent feature of the northern side of the Poplar Mountain is the occurrence of long slopes and offshoots, whose elevation is lower than that of the mountain, and from whose summits the carboniferous sandstone has been removed, leaving only a comparatively thin stratum of Chester slate and marl. Beneath this, on the slopes, the St. Louis limestones outcrop, and by gradual and slow disintegration, through atmospheric agencies, give a calcareous character to the clays and sands that, falling from above and commingling, have formed the soil.

Such limestone slopes occur on the north end of Short Mountain; on the south side of the gap that connects Short Mountain with the Poplar range; also westward, on the north side of the latter at Long's Gap, and other points.

The land of these slopes is considered the best in the county, and is generally under cultivation in small farms, producing fine crops of corn, the yield being about ten barrels per acre. The native timber growth is hickory, black walnut, white oak, poplar and sugar-tree. The soil is a dark or black loam, with a depth of from two to three feet. The following analyses of a sample of soil and subsoil have been made:

No. 2858. "*Virgin soil*; hill-side limestone soil. Long's vineyard, Cartwright P. O., Clinton county. Sample taken to the depth of ten inches. Forest growth: walnut, white oak, sugar-tree and poplar. On St. Louis limestone formation."

Soil is friable, of a light, dirty-brownish-grey color. All passed

through the coarse sieve*, except about 12.5 per cent. of small, irregular fragments of ferruginous sandstone or concretions. Its silicious residue, from digestion in acids, all passed through the fine sieve†, except a very small proportion of fine white sand.

No. 2859. "*Virgin subsoil*; hill-side limestone subsoil. Long's orchard, Cartwright P. O., Clinton county. Sample taken at the depth of between ten and thirteen inches."

Slightly lighter colored than the above surface soil; in pretty firm clods. All passed through the coarse sieve, except about four per cent. of irregular, small fragments of ferruginous sandstone or concretions. Its siliceous residue left only a small quantity of fine white sand on the fine sieve.

MECHANICAL ANALYSIS OF SOILS FROM MOUNTAIN-SIDE,
Near Cartwright P. O.

CONSTITUENTS.	Soil.	Subs. il.
	No. 2858.	No. 2859.
Gravel and rock fragments, diameter above 1 mm.	12.500	4.269
Coarse sand, diameter from 1. to .5 mm.	2.114	1.665
Medium sand, diameter from .5 to .25 mm.	.652	.629
Fine sand, diameter from .25 to .1 mm.	1.732	1.445
Finest sand, diameter from .1 to .05 mm.	23.170	23.375
Silt, diameter from .05 to .01 mm.	56.928	63.225
Clay, diameter less than mm.	2.297	3.929
	99.393	98.537

The soil contains more of the coarse sand and gravel than the subsoil, but much less clay. The percentages marking the tenacity, respectively, of the soil (59.2) and subsoil (67.2) are greater than the amounts of sand which mark the porosity. The rounded sand contains some chert, quartz crystals, particles of bog-iron ore, and when separated from the clay and silt, is brownish in color.

* The coarse sieve has about 64 meshes to the centimeter square.

† The fine sieve has about 1600 meshes to the centimeter square.

MOUNTAIN-SIDE LIMESTONE LANDS, CARTWRIGHT P. O.

DRIED AT 212° F.	Virgin Soil.	Subsoil.
	No. 2858.	No. 2859.
Organic and volatile matters	3.511	2.998
Alumina, and iron and manganese oxides	6.757	6.215
Lime carbonate	.405	.305
Magnesia	.073	.055
Phosphoric acid	.146	.065
Potash	.340	.537
Soda	.518	.247
Water expelled at 400° F	.846	.860
Sand and insoluble silicates	87.366	88.706
Total	99.962	99.988
Hygroscopic moisture	1.368	1.625
Potash in insoluble silicates	.394	.497
Soda in insoluble silicates	Not est.	.214
Gravel and rock fragments	12.500	4.269

The results of the analyses confirm the reputation of the soil for richness, for there is sufficient sand to make it loose and tillable, and lime to keep the particles of clay in a good flocculated condition. There is a good percentage of available potash (.340), and also of the same in an insoluble form (.394), stored up for future use. There is a large excess of soda, for which plants, however, seem to have but little, if any, need. The amount of phosphoric acid in the soil is fair. The subsoil, however, while rich in other elements of plant food, is deficient in phosphoric acid. Its potash is very large (.537 per cent.), and is evidently derived from the marls of the overlying Chester shales in the mountain above. These lands are regarded as the best in the county, and command highest prices. By careful treatment Capt. Hurt obtained from a tract of land, near his home on the north side of the mountain, a yield of sixty bushels of corn per acre.

THE PLAINS, OR VALLEY REGION.

Under this name is embraced all of that portion of the county lying at a lower elevation than the mountain lands, and higher than the lowlands of the streams, and covering the greater portion of the county's area. It is also the gen-

eral farming region of the county, and the eastern portion of that broad plain that extends westward through the State and southward in Tennessee to the Nashville Basin, as well as northward into other counties. The general surface is rolling and broken.

As we go north from the Tennessee State line, we find the surface sharply cut into to the depth of more than 200 feet by Wolf river in its general westerly course, and by Spring creek to a depth of less than 100 feet below the general surface in its south-westerly course from the foot of the mountain range. On the west, the Ill Will creek flows southward into the Obey river between banks that rise more than 100 feet above the stream to the general level. The minor streams of this southern part of the county do not cut so deeply into the surface.

On the north of the central mountain range, or that portion whose drainage is northward to the Cumberland river, the surface is much more broken and rough than on the south; the streams are more numerous, and generally lie in narrow channels 100 or more feet below the surface. Their small tributaries are many in number, and there is altogether a far less proportion of arable land than in the southern part of the county. Very few large areas occur which present a level surface unbroken by denudation and the washing of hill-sides.

On the west side of Indian creek the surface of the uplands, south of Grider's, near the county line, is interspersed with deep and broad limesinks. The bluffs along the creek at Grider's are covered with cedar.

There are two classes of soils—one being grey and sandy, the other red or yellow and clayey, each with reddish clayey subsoils.

The former, known as *chestnut lands*, are regarded as the poorest in the county. They cover the highest surfaces of these uplands, and have a timber growth of chestnut, sourwood and black gum, with occasionally some red oak. The soils are deep and overlie a yellow or red clay. They yield well for a couple of years, and then rapidly fail.

The other class comprises the *red and yellow lands*, which lie at a lower level, and are for the most part derived from the decay or decomposition of the cherty Lithostrotion beds lying

at the base of the Upper Subcarboniferous formation. Much of the chert debris still remains in the soils or on the surface, in places amounting to as much as 29.5 per cent. of its weight.

From the Russell county line at Grider's, southward for a mile, the uplands are entirely covered by loose sandy soils from the decomposition of sandstone. Masses of the latter still cap the bluffs near Grider's.

The specimens of soil analyzed were all taken from the northern part of the county, and perhaps are not fairly representative of the entire area. Others were taken from the southern half of the county, but were lost before reaching the hands of the chemist. Much of the upland, especially in the south of the mountain, is under tillage, producing from 15 to 30 bushels of corn per acre, and even more in fair seasons.

No. 2112.—*Virgin soil* from the farm of John Wade, on the head of Indian creek, on the Monticello and Albany road, seven miles north-east of Albany, and at the foot of Short Mountain; geological position, Subcarboniferous limestone. The dried soil is of a light brownish-grey color, quite friable and light; contains 29.5 per cent. of angular fragments of chert and somewhat rounded particles of ferruginous sandstone; also some small rounded grains of white quartz.

No. 2113.—*Cultivated soil* from a field on the head of Indian creek, on the Monticello and Albany road, seven miles north-east of Albany; was cleared in 1803; under cultivation 57 years, mostly in corn, with the use of but little manure. The dried soil is of a light snuff color, but darker colored and more brownish than the adjoining No. 2112; contains only 4.4 per cent. of somewhat rounded ferruginous sandstone fragments, with a few quartzose concretions; also a small proportion of small rounded white quartz grains.

No. 2114.—*Subsoil* of the next preceding, but slightly darker in color, and quite friable; it contains 8.2 per cent. of somewhat rounded particles of ferruginous sandstone, and also some rounded grains of white quartz.

No. 2861. "*Virgin chestnut soil*; from one mile west of Cartwright P. O.; taken to the depth of twelve inches. Forest growth, chestnut and red oak. Said to be the poorest soil in Clinton county, excepting that of Poplar Mountain summit."

The soil is of a light, dirty-buff-grey color; contains some friable clods. All passed through the coarse sieve, except about 4 per cent. of small fragments of ferruginous sandstone or concretions. Its silicious residue left about 4.5 per cent. of fine white sand on the fine sieve.

No. 2862. *Red under-clay*, of the chestnut soil, from one mile west of Cartwright P. O. Sample taken from eighteen to twenty-four inches below the surface.

It is of a dull, orange-red color; in friable clods. When powdered, it is of a handsome orange tint. The coarse sieve removed from it about 8.9 per cent. irregular small fragments of ferruginous sandstone. Its siliceous residue all passed through the fine sieve, except about 2.5 per cent. of fine white sand.

The two samples from near Cartwright's store, after the removal of the very coarse portions, were submitted to a mechanical analysis, with the following results:

MECHANICAL ANALYSIS OF "CHESTNUT LAND,"

One Mile West of Cartwright.

CONSTITUENTS.	Soil.	Under-clay.
	No. 2861.	No. 2862.
Grits, or very coarse material, diameter above 1 mm. . . .	4.000	8.500
Coarse sand, diameter from 1. to .5 mm.	1.335	.238
Medium sand, diameter from .5 to .25 mm.	1.200	.431
Fine sand, diameter from .25 to .1 mm.	3.514	1.492
Very fine sand, diameter from .1 to .05 mm.	29.060	12.032
Dust or silt, diameter from .05 to .01 mm.	58.123	74.244
Clay, diameter less than .01 mm.	2.285	1.478
Total	99.517	85.227
Porosity percentage	39.109	22.693
Tenacity percentage	60.408	75.722

The character of the soil is well seen in the above analyses, which presents the amounts of the different ingredients. It is made up almost exclusively of very fine sand and silt, which give to it a close nature.

The coarse material embraces much bog ore (though the per-

centage is small for the entire soil), a little clear, pelucid quartz and some particles of chert.

The under-clay contains more than 13 per cent. of iron, which gives to it a deep red color, and in a large measure would prevent its puddling or becoming hard, were it so uncovered as to form the soil. When separated from this iron, the sands and silt are slightly red in color and clear, the clay alone retaining a darker color from the presence of vegetable matter.

The following tables give the chemical composition of these soils :

UPLANDS OF CLINTON COUNTY.

DRIED AT 212° F.	West foot of Short Mountain.			One mile west of Cartwright's store.	
	Virgin Soil.	Cultivated Soil.	Subsoil.	Virgin Soil.	Red Under-clay.
	No. 2112.	No. 2113.	No. 2114.	No. 2861.	No. 2862.
Organic and volatile matter	3.000	4.320	4.695	2.618	5.483
Alumina	{ 2.932	{ 6.129	{ 6.247	{ 4.361	7.335
Manganese and iron oxides					13.188
Lime carbonate	.080	.295	.195	.051	trace.
Magnesia	.106	.124	.108	.109	.240
Phosphoric acid	.093	.071	.093	.064	.267
Potash	.155	.170	.188	.247	.231
Soda	Not est.	Not est.	Not est.	.256	.077
Water expelled at 380° F. .	1.550	1.940	1.500	.453	1.285
Sand and insoluble silicates	92.240	86.790	86.790	91.928	71.047
Total	100.156	99.839	99.816	100.087	99.153
Hygroscopic moisture . . .	0.900	1.800	1.515	0.700	2.625
Potash in insoluble residue.	.327	.726	.621	.422	.171
Soda in insoluble residue .	.269	.263	.169		

The soils and subsoils in the above groups are notably deficient in phosphoric acid ; and especially so are the clayey cultivated soil and subsoil from the foot of Short Mountain, which, instead of less than one-tenth of one per cent., should have at least that amount. The same deficiency also extends to the clayey soil near Cartwright's store, but its under-clay is amply supplied for the benefit of deep-rooted crops.

In available potash the Short Mountain land is rather poorly supplied for lands so clayey, while that from Cartwright, a fairer representative of the general lands of the county, has

an abundance for the need of a crop for many years. The insoluble portion of the cultivated land holds a large percentage of potash in a condition unsuited to the use of the plant, and the presence of a decomposing agent is necessary to render it available. Such an agent is found in the lime and magnesia present, but which occur in such small amounts as to require supplemental applications after a few years' cultivation. The poorer class of lands—ashy-grey in color—are said to produce well for a couple of years, but afterward are rapidly exhausted.

The uplands yield a good quality of tobacco at the rate of about 600 pounds per acre. Cotton is planted in small patches, both in the southern and middle portions. It is said that on unmanured land the stalk is low, and the bolls are caught by frosts before maturity; but when manured a good-sized stalk is obtained, the bolls all mature, and give an average yield of 1,200 pounds of seed-cotton per acre.

Flatwoods.—This name is given to a level tract of land covering about 1700 acres, near Capt. Hurt's, at the south foot of Richland hill, a few miles north of Brown's Cross Roads. The entire tract is subject to overflow, and is not under cultivation. Small streams flow through the land to the foot of Richland hill, beneath which, underground streams carry the drainage to the northward. It often happens that the latter streams are insufficient, and the hill thus acts as a barrier or dam to the water and causes the overflow, which assumes sometimes a depth of eight or more feet. The timber of these flatwoods comprises post and white oaks and chestnut (on the higher places), and the mast from these trees makes this section an excellent resort for hogs. Foxes are said to exist in great numbers.

LOWLANDS.

The lowlands of the county comprise but a very small proportion of its surface area; and where the conditions are favorable, nearly all is under cultivation. Indian creek on the north-east lies, for the greater part of its course, northward from the mountain, between high sloping bluffs that rise, usually, but a few feet back from the water's edge, leaving a very narrow bottom. It is only just above the junction of Laurel branch

that the bottom widens, and for a distance of about one and a half miles to the county line gives a sufficient, though narrow, area for small farms. The surface is highest near the foot of the bluffs, the lower portion being subject to overflow from back-water from the Cumberland river.

On the tributary streams, Laurel and Brown branches, these flat lands reach back from the creek for a short distance, giving a small additional farming area. On West and Middle forks the bottoms extend up about a mile before being cut off by the bluffs.

The soil of these bottoms is very sandy, and is underlaid at a small depth by Silurian limestones. On approaching the Cumberland river, in Russell county, the bottom widens and furnishes a much larger area of cultivable land.

The creeks in the north-western part of the county give comparatively no bottom lands, within the county, of sufficient width for farms.

Willis creek, from the junction of its several forks near the salt well, down to the county line, has a narrow bottom, in which are located some small farms of a few acres each.

In the southern part of the county, along the streams tributary to Wolf river, the same features characterize the bottoms as on the north, viz: high sloping bluffs, and very narrow valleys, through which the stream flows, cutting first the foot of one bluff and then that of the other, often allowing only sufficient space for a road-way; near the junction with the river, the width of land on either side increases. Tracts of sufficient area for small farms are occasionally found in the bend of the stream, and these are mostly under cultivation.

Spring creek, on the south-east, with its tributaries, is exceptional in its features for the greater part of its course from the mountain on the north-east to Wolf river; for while there is but little tillable land along its banks, the uplands that rise above it are not so precipitous or high as elsewhere. The deep groove, cut between abrupt bluffs, that is so marked a feature of nearly all the streams of the county, is here lacking until within a couple of miles of its junction with Wolf river, except, perhaps, at a few points.

Ill Will creek, on the west and south-west, has, throughout

its entire course, very little bottom land, even in the bends of the stream. Within a short distance of its headwaters its bluffs are high and precipitous, and this feature continues south to Wolf river. Just below the junction of Fanny creek the bottom widens and furnishes the chief area of land suitable for tillage.

Cumberland river forms the boundary of the county for only a few miles on the north-west, its outward bend giving to the strip of land a small pan-handle appearance. Within this bend the high uplands reach close to the river's edge on the north-east, but on the south-west there is a broad area of lowland, known as Wells' bottom. The latter is terminated, however, at the next bend of the river southward, where the uplands of Tear Coat creek reach the river, and where, too, the west boundary of the county begins. The surface of the bottom is about 40 feet above low-water and is subject to overflow. The soil is light sandy in character.

Wolf river, on the south west, has in the aggregate a larger area of tillable land than the Cumberland river. The bordering bluffs are high and precipitous, and the bottom lands lie chiefly in the broad bends of the river. Along the immediate river front the lands are low and sandy and subject to overflow. Their timber growth is chiefly beech, sugar-tree and red elm. The land under cultivation yields in fair seasons from 50 to 60 bushels of corn per acre. Back from the river the lands are higher.

This page in the original text is blank.

SCHEME OF COLORS

Quaternary	River Alluvium
Carboniferous	Lower Coal Measures
Sub-Carboniferous	Upper
Carboniferous	Lower
Devonian	Black Slate
Lower Silurian	Upper Hudson River

GEOLOGICAL SURVEY OF KENTUCKY
John R. Procter, Director.

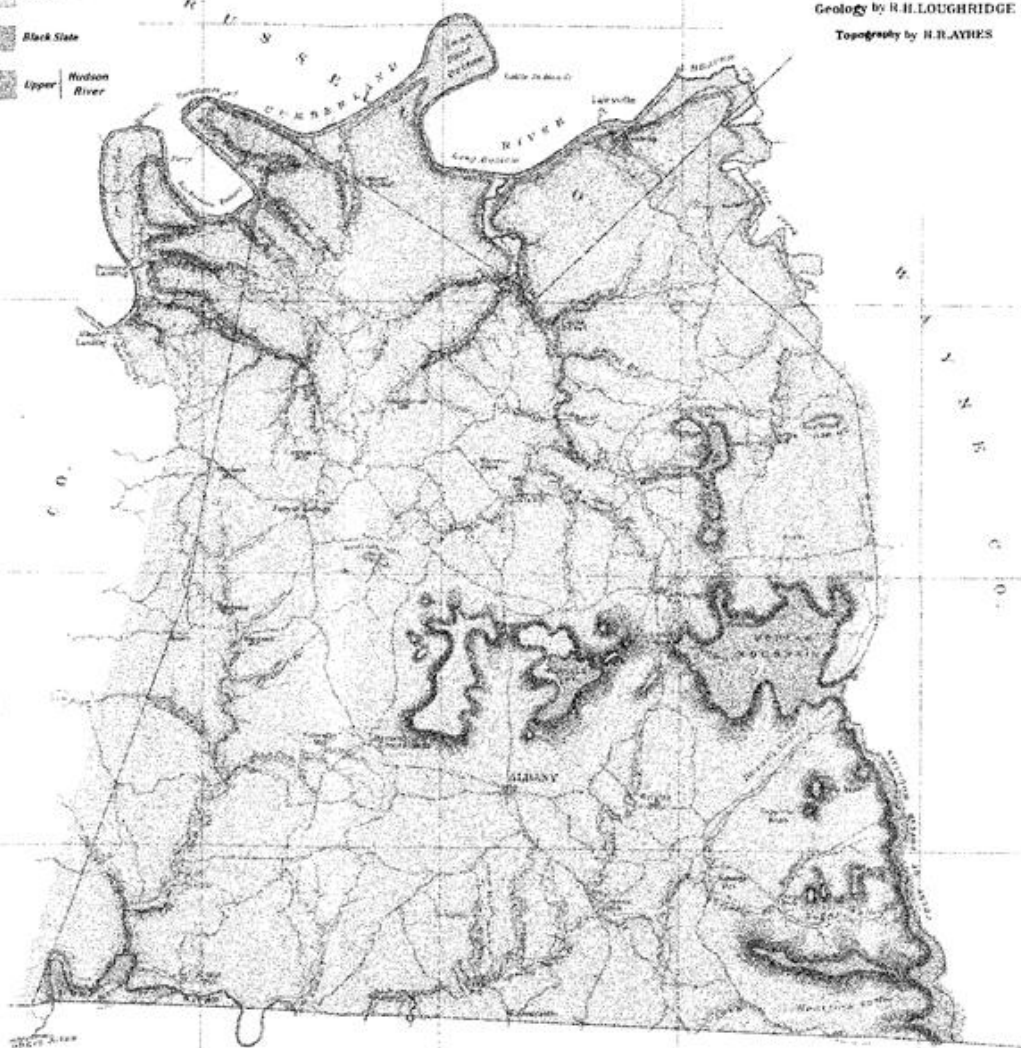
MAP OF
CLINTON COUNTY

Scale: 2 Miles = 1 Inch.



Geology by R. H. LOUGHRIDGE

Topography by H. R. AYRES



CONVENTION OF SIGNS

—	Roads
—	Streams
—	Railroads
—	Salt Wells
—	County Lines
—	State Line