GEOLOGICAL SURVEY OF KENTUCKY.

JOHN R. PROCTER, DIRECTOR.

REPORTS ON THE GEOLOGY

OF

HENRY, SHELBY AND OLDHAM COUNTIES,

BY W. M. LINNEY.

WITH COLORED MAP.

STEREOTYPED FOR THE SURVEY BY JOHN D. WOODS, PUBLIC PRINTER AND BINDER, FRANKFORT, KY.

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INTRODUCTORY LETTER.

HON. JOHN R. PROCTER,

Director of the Kentucky Geological Survey:

DEAR SIR: I herewith submit to you my reports and map on the Geology of Henry, Shelby and Oldham counties. As the three counties are represented on one map, it seems fit that the three reports should be printed under one cover.

Yours respectfully,

W. M. LINNEY.

HARRODSBURG, KY., January, 1887.

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GEOLOGY OF HENRY COUNTY.

GENERAL NOTES.

In 1798 the Legislature of Kentucky created the county of Henry from a portion of Shelby. It has, since, lost portions of its original territory in the formation of Trimble and Carroll. It was named in honor of Virginia's Governor and celebrated orator, Patrick Henry. Situated to the north of the central portion of the State, it is included in the district generally known as the blue limestone region, and bounded by Carroll on the north; Owen on the north-east, separated by the Kentucky river; Franklin on the south-east; Shelby on the south, and Oldham and Trimble on the west and north-west. In 1880 its total population was 14,492. Its area comprises about 175,000 acres of land. NEW CASTLE, the county seat, is pleasantly situated, and surrounded by rich grazing and agricultural lands. Eminence, Pleasureville, Smithfield, Jericho, Pendleton, Sulphur, Campbellsburg and Turner's Station, are points on the railroads, the first mentioned being the largest and most important place. Guestville and Lockport are on the Kentucky river, and Port Royal, Franklinton, Bethlehem and Harper's Ferry, are small villages of the county.

The Kentucky river flows along the entire length of the county on its north-eastern border, where navigation for steamboats is continuous through the entire year. There are locks and dams at Guestville and Lockport, and a number of landings on the river which add much to the convenience of travel and shipping. The Louisville, Cincinnati and Lexington Railroad passes through the county, the Lexington division through the south-western and the Cincinnati division through

the western part. The county has two hundred miles of turnpike, and more will be constructed in the near future, as some parts of the county are greatly in need of improved roads. There are three chartered colleges located, respectively, at Eminence, Sulphur and Campbellsburg, while at New Castle, an University for Colored Youths has been organized. The common school system in the county is in about an average condition.

The elevation of pool No. 3 on the Kentucky river is 455½ feet above sea level, and the highest points in the county are about 500 feet higher still. These higher points are along the southern border, and form the water-shed between the waters flowing into the Kentucky and the Salt river, respectively. Nearly all the drainage is into the former, through Flat, Sand Ripple, Stevens, Pot Ripple, Six-mile, Drennon and Cane creeks, strictly within the county, and through Mill creek and the Little Kentucky river, which reach Henry through Carroll and Trimble counties. Harrod's creek heads in the western part, and reaches the Ohio through Oldham and Jefferson, while some small branches, heading in Henry, reach Salt river through Floyd's Fork and Brashear's creek. The whole surface of the county is well drained, the larger part having deep lines, which have been excavated several hundreds of feet beneath the general surface.

GENERAL GEOLOGY.

A connected section of the various divisions of the rocks in the county gives a total of nearly 900 feet. With an actual elevation of less than 500 feet, it must be seen at a glance that the formations are not horizontal, but must have a considerable dip. The rocky floor of the county has a strong dip towards the north-west. This can be easily seen along the Kentucky river, where nearly 400 feet of strata, exposed at the southern edge of the county, have disappeared under the river, when reaching its northern line. The greater dip is west of the trend of the river here, and can not be seen, but may be estimated from the elevation of Smithfield, Jericho and other points, and from the thickness of the different divisions. The

following table shows these divisions with their approximate relative thickness:

Age.	Period.	Group.	Feet.	Feet.
Quaternary	Recent.	Alluvium.	. . . . .	30
Upper Silurian . .	Niagara.	Niagara. Clinton. Medina.	10 15 12	37
Lower Silurian or Cambrian . . .	Hudson river.	Upper beds. Middle beds. Lower beds.	300 150 200	650
	Trenton.	Trenton.	. . . . .	165
Total	. . . . .	. . . . .	. . . . .	832

TRENTON PERIOD.

TRENTON LIMESTONE.—The Trenton limestone is the only division of the period to be seen in the county. The others, which are exposed higher up the river, have been carried beneath the water before the Henry line is reached. On Flat Lick creek, and on the river, near the former's mouth, about 165 feet of the rocks which constitute the upper portions of the hills at Frankfort, are exposed above the water. The top of this section consists of roughly stratified limestones, having a granular structure on exposed portions, and splitting into thin and often wedge-like fragments when affected by the action of the atmosphere. Something like 100 feet of heavy layers underlie them, with very little shaly matter between them. Underneath the latter are thinner layers with shale partings, down to the water's edge.

Near the top, at nearly every horizon, may be seen, wasted from the layers, small fragments of white flinty chert, while, at or above the same horizon, the following fossils are found: *Rhynchonella increbescens*, *Orthis borealis*, *Orthis lynx* (small form), *Murchisonia bicincta*, *Murchisonia gracilis* and *Zygos-*

pira modesta. Lower down, near the river, the orthis bed of Safford is plainly visible with its multitudes of *Orthis testudinaria.*

The soils derived from these rocks are excellent, but of limited extent. There are coves at the mouth of the branches, where the action of the currents has cut down the shales, and some of these are desirable lands. The dip down the river to Lockport seems to be over seven feet to the mile; below, in about the same distance, it is over twenty, but it is probable that the latter is partly produced by a line of fault which could not be seen on the river. Some quarrying has been done near Lockport in the Trenton, where it exhibits the same character as at Frankfort, but there are no layers which work easily, though containing some good stones. Some of the fossil layers are quite handsome when polished. The outcrop of this formation may be readily seen by reference to the map.

HUDSON PERIOD.

LOWER HUDSON BEDS.—Overlying the rocks of the Trenton are two hundred feet of hard limestone, between nearly every layer of which there is more or less shale, which shale appears frequently as a blue mud, and is locally known as soapstone. These rocks rise to the top of the hills, along the river, in the south-eastern part of the county, and extend up the creeks, for considerable distances. They, like the Trenton limestones, dip down the river, and are lost to view near the Carroll county line. The soils on these beds are, in part, warm and dry. This condition applies to those near the upper part, where there is not much stiff clay, but the soils derived from the layers near the base, where the shale deposits are heavy, are stiff and cold, and on level surfaces they are wet and difficult to cultivate. These wet portions, though very small, make excellent meadows and pastures if properly treated. The limestones, while very durable in some of the layers, are seldom evenly bedded. They furnish stones for local use in building foundations and pikes. The fields on this formation are usually covered with loose blocks of stone, which seriously interfere with good cultivation. Nearly all the exposures are on hill-sides, and owing

to their natural character, and the little care given them, there is much worn land on them. Most of these lands should be in grass, being well suited for pastures. The trees upon them were largely white oak, not much of which is left at this time.

MIDDLE HUDSON BEDS.—Lying on the lower beds, and rising higher over the county, are something over 150 feet of limestone, sandy-like layers and sandy shales. There is not so much of the siliceous in the mudstones here as is the case higher up the river in Garrard, Madison and Clark; and the heavy layers of concretionery character, so finely exhibited in those counties, are entirely absent. The general characters are, however, the same, and the narrow ridges, rounded slopes and deep cut drainage lines are alike. The tops of the ridges, and usually the slopes based on this series, have been cleared and cultivated with but little rest or care. No fertilizers have been used, and the result is, that much of the land on them is to-day worn into deep gullies, and the surfaces covered with the sandy shales.

Naturally very fertile soils, they should have been kept so, and with care they might all be in good condition now. Some of them are being more worn every year, and becoming more difficult to restore. Restoration, while possible with all of them, will never be undertaken by their present owners. It would be very desirable that another class of tenants should own them, who would give them that care of which they are so much in need. These lands were originally covered with a forest of beech, among which white and red oak, hickory, poplar, walnut and sugar maple grew; but all of them have been largely destroyed, and many farms which should have their slopes clothed with forest have not even trees for fencing or firewood.

Many of the slopes ought to be kept in grass, and, if cultivated at all, should have several belts of grass running around them, parallel with the cultivated portions. Judging from the rough character of the surface, the lands in the eastern part of the county, and along the Kentucky, have not been held in as high esteem as their real worth would seem to have demanded. Slanting to the north-west, with the general dip of the rocks,

tLey are but little above the deeper lines along the boundary of Carroll county.

UPPER HUDSON BEDS.—The larger part of the surface of the county is based on the upper division of the Hudson beds. They comprise the most elevated and the most desirable portions. The rocks of this group are all limestone, having, in the lower part, but little shale between them, but a large amount in the upper portion. On the dividing ridge, about Eminence and other points, no rocks are to be seen, the exposures only exhibiting a loose, friable clay soil. The limestones throughout are filled with fossils, which give them a shaly and easily disintegrating character, and while some of the layers have been quarried for local use, they do not rank well for building purposes, stones for which are mostly brought from other points. There are often large specimens of *Columnaria alveolata* in the clay beds, which serves to show that the beds holding them were quite extensive at the top of the Hudson.

The beds of *Orthis lynx* are finely exposed at many places, and great numbers of these fossils, with their associated forms, may be seen. There are many beautiful and well kept farms on this division in Henry county, much of the land being in grass, and the tillable fields, owing to their rather level surfaces, are kept more free from the worn and exhausted condition so often seen in the fields of the other formations. Not all of the lands, however, have received judicious treatment, and here and there, what should be fertile farms, are only wasted and gullied soils.

The lower part of these beds I found to hold a forest of blue ash, wild cherry, chinquapin oak, hackberry and the other trees so peculiar to this group in Kentucky, but with a mixture of beech, a rather unusual thing. The upper part is, in many places, a forest of beech alone, while in other places white oak or sugar tree constitutes the principal growth. All the soils of the county seem to have had more or less beech growing over them. On the ridge near Eminence I found a narrow stretch of wet lands, and over them the beeches were quite thick. These places are very fine for meadow land

to-day, their level position, clay soils and damp character making them particularly valuable for the growth of timothy. Tobacco has, for some years, been the great staple of this county, the texture of the leaf being very fine. Injury has resulted to many farms from its cultivation, and from the manner in which the fields are left when the crop is removed.

Analyses of Upper Hudson soils of Henry county were made by Dr. Peter a number of years ago, which are here reproduced. These samples were taken from a locality two miles south of New Castle, and the analyses were first published in Vol. III, Old Series, of Kentucky Geological Reports. No. 649 is virgin soil; No. 650, old field soil, and No. 651, subsoil:

	649	650	651
Organic and volatile matters	5.180	5.159	4.918
Alumina	2.515	3.915	4.125
Oxide of iron	3.940	4.115	4.545
Carbonate of lime	.372	.496	.396
Magnesia	.503	.558	.512
Brown oxide of manganese	.170	.220	.160
Phosphoric acid	.615	.407	.448
Sulphuric acid	.101	.101	.085
Potash	.284	.298	.227
Soda	.132	.133	.067
Sand and insoluble silicates	85.900	83.760	84.943
Loss	.288	.838	. . . . .
	100.000	100 000	100 426

"These soils," writes Dr. Peter, "present almost the only anomaly in the whole of the soils analyzed, of the existence of larger proportions of lime, magnesia, oxide of manganese, potash and soda, and a smaller proportion of sand and insoluble silicates, in the soil of the old field than in the virgin soil from the same neighborhood. The organic and volatile matters are in nearly similar quantities in the two soils, but the virgin soil gives up a much larger proportion of soluble extract to the water charged with carbonic acid; and the amount of phosphoric acid in this latter is also much the larger. If no error has been committed in putting up and labeling the soils, or no accidental substitution has occurred since, this anomaly can only be explained on the supposition that the soil of the old field was originally much stronger than that of

the neighboring one from whence the "virgin soil" was taken, a case which seems to be rare. The subsoil does not appear to be better than the soil of the old field."

UPPER SILURIAN.

On the ridge of land extending from near Jericho to Sligo, and along the higher points near the line of Carroll and Oldham, are the remains of part of the Upper Silurian. There are but few exposures, and none where the extreme thickness can be determined. The Medina is in place with its peculiar earthy and sandy texture. Some of the layers of the Clinton with its chert beds can be partially seen; and the Niagara shale makes local beds of stiff clay. At Jericho and at Pendleton some quarrying has been done in the beds of the Niagara limestone. One layer contains specimens of *Calymene Niagarensis*. As these beds are more fully seen in Oldham county, the reader is referred to the report on that county for more extended notes on them.

QUATERNARY.

ALLUVIUM.—Since the Kentucky river has excavated its channel to its present depth, its waters have wandered from side to side, and, in places, cut out wide bottoms which have been filled—except where its immediate channel runs—with the gravels, sands and mud brought down from above. These materials have been assorted by the current, and arranged in layers, one over the other, as the conditions for their deposition varied. All the gravel and sand have been derived from the siliceous rocks which are in place higher up the stream, while the earthy matters, with organic materials, have come, in part, from the washings of the fields in Central Kentucky.

The bottoms are usually rich loamy soils, with slopes to the river sufficient to give nearly always ample drainage; and they are much valued for agricultural purposes. Some of the deposits referred to are valuable as materials for brick-making. The bottoms have all been cleared and are under cultivation.

OTHER GEOLOGICAL FEATURES.

DISTURBANCES.—A line of disturbance in the rocks is noticeable crossing the road from Drennon Springs to Franklinton, and near the former place. On the north-west of this line the rocks are nearly horizontal, only having, perhaps, the general dip of the region ; but on the south-east they have a steep incline in the latter direction. This is a regular fault with a down-throw of over 150 feet. The Middle Hudson has dropped entirely into the break, and the lynx beds of the Upper Hudson have been brought down to nearly a level with the top of the Lower Hudson. How far this disturbance extends I could not determine, but it seems to be purely local. The line of strike is north-east and south-west, with steeper dip to the south-east, like all the faulted places in Central Kentucky. This one was evidently produced at the time of the uplift of the Kentucky Anticlinal, and as a local phase of that axis.

In a sharp bend of the Little Kentucky river, about one mile above Sulphur Station, there is a small area of disturbed rocks. It crosses the river twice within a few hundred yards. When the water is low and clear, or too low to cover the rocks, as I found it, it exposes a very interesting type of the small anticlinals, which are often to be seen in the Hudson beds of the central part of the State. A much smaller fracture was seen crossing Tall Timber creek, some two miles from Sulphur.

WASTE OF HIGHER BEDS.—There are several places in Henry county where considerable quantities of hard siliceous rock are scattered over the surface. The rock has been derived from layers which once extended much higher than the present hills. These fragments are parts of the more indestructible portions, and have remained while many hundreds of feet of the softer rocks inclosing them have dissolved and been carried away. Over the tops of the ridges and in the beds of the branches, to the south-east of the fault near Drennon Springs, there are many pebbles from the conglomerate, geodes from the Subcarboniferous, and chert from the Niagara and the Corniferous.

The down-throw of the strata above mentioned produced a depressed area on the surface, and it was long before any drain-

age lines emanated from it; so, while the general surfaces were subjected to great erosion, this point was protected. Though the rocks were disintegrated, limestones and shales dissolved and leached away, the very resisting portions were left in the pocket, and held there for a great length of time Since the basin-like area has been destroyed, the washing of the surfaces has not yet been great enough to remove all of the debris. It is by the present position of these beds, and by the conditions surrounding them, that we are enabled to determine the time of the disturbance to have been after the formation of the coal measures; and to know that Central Kentucky has, in time, had a vast mass of material removed from over its present surface.

At the head of Stevens' creek there are also many of these rocks left in the heads of the branches, and continually working lower and lower down the streams. These accumulations are from three to six miles from the Kentucky river, and 400 feet or more above it. They are in no way assorted into sizes, as water would assort such materials, and could not have been left by the river or any other stream. In all the debris of this character, as seen over the Lower Silurian area of the State, its preservation seems to be due to some such condition as exists near Drennon Springs.

MINERAL SPRINGS.—Henry county has a number of mineral springs, all issuing from the rocks of the Lower Silurian age. In the bed of Sulphur creek a weak sulphur water comes to the surface, which is occasionally used for drinking purposes. At Eminence, a spring comes from near the railroad fill, which has a very slight chalybeate taste, and is rather a pleasant water. Towards the head of Drennon creek there are several springs containing mineral ingredients. One of these is quite strong with salt, and another with sulphur. Farther down the creek other waters, more or less impregnated with these matters, issue from the rocks. All of these have their sources in the Upper Hudson, and neither of them possess any characteristics of value or have local reputations.

The principal springs are situated in the valley of Drennon creek, some two miles from its mouth, and issue from the

Lower Hudson, near its base, or rise up through the alluvial deposits from the beds of the Trenton. The Drennon Springs have been known since the earliest settlement of the State, at which time they were resorted to by herds of buffaloes, deer and other animals, who came to lick the saline waters. For this reason they were known, for a long time, as Drennon Lick. Some thirty-five feet above the creek, and a few hundred yards from it, there issues, from near the base of the Lower Hudson rocks, a spring of very clear and very pleasant white sulphur water. A stone cistern has been built around it, and the water rises some six inches above the surrounding surface, when it runs off through an opening in the side. At several places, within a few yards, the same water breaks from the ground.

In the bottom below the above spring, and on both sides of the creek, black sulphur water rises up through the deposits made by the stream. The alluvial is some twelve feet above the bed of Drennon, and the vents from which the waters come up have evidently been produced by the pressure of gas, which escapes in a succession of bubbles, at intervals of a few seconds. In a number of these places gums have been sunk into the ground, to the depth of seven or eight feet, and in them the water rises above the general surface. Considerable deposits of black mud have been made through the action of these waters, and, around the surfaces of little pools formed by them, incrustations of whitish yellow sulphur are to be found. All these waters are saline; and, while there is some difference in their taste, this is due to the different proportions of sulphuretted hydrogen and salt, which may be combined in the water at any particular time or place.

Drennon Springs, now owned by Messrs. Jett and Scott, of Frankfort, was once quite a fashionable watering place, where yearly many visitors used to gather. There is at present very little accommodation for visitors, yet each year a greater or less number of people go there to drink the waters, and bathe in them. To some extent the water is being shipped all through the year. Its most prominent ingredients, according to Dr. D. D. Owen, are:

Free sulphuretted hydrogen.
Chloride of sodium (common salt).
Sulphate of soda.
Sulphate of magnesia.
Bicarbonate of lime.
Bicarbonate of soda.
Bicarbonate of magnesia.

On the north side of the creek, in the bottom, there is a slight depression, which, for a long time, existed as a deep miry flat, but when I saw it, was solid enough to bear the weight of a wagon. This place is incrusted with the deposits of sulphur. Above it, on the side of the bluff, the fragmental blocks of the Trenton have the appearance of having been subjected to some degree of heat; but it is probable that this is due to the action of the salt and gas, which has, for ages, passed up between them.

Some of the layers of the Lower Hudson, as well as of the Trenton, are freely impregnated with sulphide of iron, and thus give rise to the gas which, in places, imparts sulphur to the water of wells and springs. The shale beds of the Lower Hudson, in many cases, carry stores of saline matters, and to the above two facts we must look for the origin of Drennon Springs. The Upper Blue Lick Spring has its position in the same geological series, and the waters of the two places are very much alike. The dislocation of the rocks which occurs near these springs, may have much to do with the artesian-like flow of some of them, and the gases may possibly be generated at a great depth. The decomposition of the organic matters in the bottoms could not give rise to the character and volume of gas evolved.

The amount of gas required to give the water its present character is quite small, and it must not be presumed that the conditions here are favorable to drilling for natural gas. The slight pressure shown in its escape, and its rising over several hundred yards of surface, show that it escapes as freely as it is generated, and that there are no conditions here warranting the existence of any reservoirs holding large supplies of it.

At Sulphur Station a well was bored a number of years ago, from which gas escaped. This was set on fire and burned for

a day or two only, when the volume was exhausted and the well filled up. No favorable conditions seem to be underlying our Central Kentucky rocks, for the production of natural gas in paying quantities. That it exists in many places, in small quantities, can not be disputed, but the fissured character of the rocks has, for many ages, allowed its free escape. At the same time, we know of no layers or beds, as low down as our knowledge extends, in this part of the State, whose conditions are favorable to the production of any large quantities of oil or gas.

MINERALS.—In Central Kentucky there are some twelve counties in which occur true fissure veins, inclosing heavy spar (barytes). Frequently there is some calc-spar or fluor-spar associated with it. The heavy spar often incloses crystals of galena (lead ore) and zinc-blende. These veins penetrate the Trenton, Bird's-eye and Chazy limestones, as far as exposed, and probably to a much greater depth. Nowhere that I have been enabled to see them, do they rise into the overlying beds of the Hudson period, and the veins seem to have been produced and filled at the close of the Trenton, rather than at any subsequent time. They, everywhere, seem to be distinct from the faults and dislocations which involved all the rocks at the close of the Carboniferous.

At numerous places in the counties referred to attempts have been made to work these veins for lead or other minerals. All such attempts have proved utter failures, and the time and money spent upon them has been lost. In Henry county, near the Kentucky river, in the region around Lockport, there are a number of small veins known, several of which have been dug into. On a vein a short distance below, there has been considerable mining done. Three or four companies have operated at this place, on what is known as the "silver and spar mines," and altogether, perhaps, much over a hundred thousand dollars has been lost in the enterprises. The lead in those veins contains no silver, and neither the spar, galena or zinc, will pay for the heavy expense required in mining these places. It is truly unfortunate that we have any veins of this character, as they, too

often, have been only sink-holes, into which a great deal of capital and labor have been buried. (For further information on this subject, see Mr. Norwood's report on the Lead Region of Henry county, in Vol II, New Series, Kentucky Geological Reports.)

A single layer of stone in the Hudson beds, frequently has small nodules of zinc associated with crystals of lime, and the finding of these often excites more interest among the people than their importance warrants. It is not unusual for persons, controlled either by ignorance or design, to go to those places, pretending with forked switches, copper wires, and balanced strings, to follow veins across the country, giving distance, depth, width and character of alleged deposits in feet and inches, as if they had been accurately measured. In view of the fact that such individuals are ignorant of ores and their distribution, and that they never have been known to own any minerals, themselves, or to be benefited by their assumed knowledge, it is strange that men, otherwise sensible, will risk their time and money in pursuing mere phantoms. It may well be assumed as a fact, that, in Henry county, there are no mineral deposits that will ever pay for working them.

ARCHÆOLOGY AND BONE BED.—No mounds or other structures seem to have been erected by prehistoric tribes in Henry county, though, in places, numerous implements belonging to their time have been found. Over the whole area there may, occasionally, be found an arrow-head of flint or some other stone. In the excavations for the railroad track at Eminence, a bone bed was found, in which the remains of the mammoth occurred. The bones and teeth were so far decayed that they could not be preserved. They were but little below the surface, and the conditions were not favorable to long preservation.

APPENDIX A.

STATISTICS OF HENRY COUNTY, COMPILED FROM THE UNITED STATES CENSUS OF 1880, THE AUDITOR'S REPORT OF 1885, AND OTHER SOURCES.

1880. Total population	14,515
1870. Total population	11,066
1860. Total population	11,949
1880. White population	11,623
1870. White population	8,628
1860. White population	8,602
1880. Colored population	2,869
1870. Colored population	2,438
1860. Colored population	3,347
1880. Foreign population	196
1880. New Castle population,	500
1880. Eminence population	1,043
1880. Number of farms	1,473
1880. Acres improved land	123,446
1880. Value of farms, buildings and fences	$4,308,672
1880. Value of farm implements and machinery	$111,319
1880. Value of live stock	$543,050
Cost of building and repairing fences, 1879	$36,603
Cost of fertilizers, 1879	$828
Estimated value of all farm products, 1879	$924,470
Assessed valuation, real estate,	$3,155,255
Assessed valuation, personal property	$858,561
Assessed valuation, 1885 total,	$4,082,761
Taxation, State, 1885	$21,313
Miles of railroad	30.30
Value of railroads in the county	$675,050
Miles of turnpikes	200
Average cost of turnpikes per mile	$1,200
Total cost of turnpikes in county	$240,000
Value of horses and mares, 1885	$217,764
Value of mules and jennets, 1885	$22,335
Value of sheep, 1885	$32,474
Value of hogs, 1885	$27,226
Value of cattle, 1885	$106,090
Pounds of tobacco, 1885	3,777,750
Tons of hay, 1885	4,170
Bushels of corn, 1885	370,910
Bushels of wheat, 1885	50,634
Acres of land, 1885	175,000
Average assessed value per acre, 1885	$16.19
Pupil children, 1885	4,857
Floating debt 1885	$10,000

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OF KENTUCKY,

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REPORT

ON THE

GEOLOGY OF SHELBY COUNTY

WITH MAP.

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GEOLOGY OF SHELBY COUNTY.

GENERAL NOTES.

Shelby was the twelfth county organized in Kentucky, and dates back to 1792. It was named in honor of Isaac Shelby, then Governor of the State. From its original area have been formed, in whole or in part, the counties of Spencer, Oldham, Gallatin, Franklin and Henry. Its location is in the north-central part of the State, and it is bounded, on the north by Oldham and Henry; east by Franklin and Anderson; south by Spencer, and west by Jefferson. In 1880 its population numbered 16,813 souls, while its area was computed at 249,000 acres. Shelbyville, situated on Clear creek, near the center of the county, is the county-seat, and, at the same time, the principal town. Christiansburg, Simpsonville, Hardinsville and Clay Village, are smaller towns, and Bagdad, Harrisonville, Southville, Consolation, are the names of small villages. Besides the places mentioned, there are several stations on the railroads. Shelby ranks high among the best counties of the State for its fine soils and actual wealth.

The drainage of the county is in nearly every direction. In the north-eastern part, it is effected through Six-mile creek into the Kentucky; in the eastern portion, into North Benson and Big Benson, thence into the Kentucky, at Frankfort. In the western part, some of the branches reach Floyd's Fork, but the larger number, through Guest's and Brashear's creeks, enter Salt river, at Taylorsville, Spencer county. Much of the surface is beautifully rolling, while some portions, particularly along Franklin, Anderson and part of Spencer, are deeply cut by the water lines, but the slopes, while steep, are seldom rough.

The Lexington division of the Louisville, Lexington and Cincinnati Railroad passes through the north-eastern corner of the county, while the Bloomfield branch of the same system

extends through the south-western portion. Two hundred and sixty-five miles of turnpike have been constructed. Other pikes and another railroad are proposed, and, if built, will supply the county with all the conveniences for travel that can be desired. At Shelbyville there are a male college and three female schools of high grade. The balance of the county is well supplied with common schools.

Jeptha Knob is an isolated hill six miles east of Shelbyville, which rises over three hundred feet above the general surface. This is the highest elevation in Central Kentucky, and from its top an extensive view may be had. Widely extended pastures and strips of forest land can be seen for many miles on every side.

GENERAL GEOLOGY.

There is no exposure of rocks of great thickness in Shelby county. All the beds of the Hudson period are present, but below them there is but a small part of the Trenton, and above them only a hundred feet of the Upper Silurian. The full exhibit appears in the following section:

Upper Silurian			100
Lower Silurian	Hudson period.	Upper beds 300. Middle beds 150. Lower beds 200.	650
	Trenton period.	Trenton limestone.	35
Total			785

Big Benson creek, for a short distance, separates Shelby from Franklin county, and here the stream has eroded its bed some thirty-five feet into the Trenton limestone. The quality of these is the same as that of the upper part of the formation, throughout its outcrops in the State. Their best presentation is at and near Hardinsville, where they exhibit their granular character, on long exposed surfaces. Some of the layers that are so unevenly bedded were quarried during the construction of the turnpike, many years ago. The alterations on the

straight cut quarry-faces have been such that most curious markings have been produced, showing a kind of cross-stratification.

The usual fossils characteristic of the upper part of the Trenton are to be found along the bluffs of the creek. There is very little soil derived from these beds, and what there is, is more or lesss mixed with those from above. It is evident, therefore, that this section presents, in Shelby, nothing of particular interest. The rocks from which the best soils of Woodford and Franklin, though not more than a score of miles away, are derived, are sunk beneath the formations which give character to the surface features in Shelby. They, here, only rise some thirty-five feet above the creek bed, being covered with the next higher division.

Lower Hudson Beds.—On the eastern side, and in the south-eastern corner of the county, all the water lines have cut down through these beds, exposing them in many places. They nowhere rise to the level of the general surface, but appear in the bottoms of the streams, and are forming the sides of their valleys. The valleys are never wide, where this condition exists, but, on the contrary, are often quite narrow, with steep, but not precipitous sides. The usual rocks of the group are constant, and the stiff clay beds derived from the shale between the thin limestones in the lower half, are usually visible. The creek beds are generally rough, owing to the disposition of the shales to wash out from beneath the layers of rock, allowing the latter to stand out in step-like projections, or to fall in the bed, and to gather, here and there, into large accumulations.

The upper part breaks down, and the blocks cover the slopes until, in many cases, they have to be removed from fields before these can be cultivated.

The outlines of these beds, where brought to view, can readily be traced by an inspection of the map. The general north-western dip of all the rocks of the county carries the Lower Hudson rapidly beneath the other and higher rocks, so that they show on one side of the county only. One of the most interesting features illustrated by this group, is the pres-

ence, wherever exposed in the State, of the large wave-marks so often mentioned in the reports on the counties of Central Kentucky. On the road from Mt. Eden to Southville, just before reaching the bridge over Little Crooked creek, there is, in the bottom of that stream, the largest and most perfect exposure of them that I have seen. The erosion by the water has uncovered a rather large surface, on a single bed of stone, and its top, as far as visible, is regularly marked with the ridges, four or five inches high, twelve or fourteen inches wide, and some three feet apart. The several other layers approaching this beautiful structure were found at various places. The greatest exposure of these beds in any of the civil districts of the county, is in the Harrisonville precinct. The soils over them have not retained their original fertility, for they are disposed to wash away by heavy rains; and many of them, which were cleared years ago, are to-day badly worn, though, in many cases, they have been much improved after almost total exhaustion. White oak, red oak and sugar maple constitute the largest part of the growth over them. These slopes are excellent grass-lands, if pains be taken to get a heavy sod over them, and to protect it afterwards. On the small farms these soils are plowed too often, and, if set in grass, cut so close that you can rarely see their better character.

MIDDLE HUDSON BEDS.—This division, which rises to the uplands for some distance along the Franklin and Anderson county lines, and, to a less extent, on the boundary of Henry and Spencer, has furnished quite large tracts of distinct soils.

Under the above heading in the notes on Henry county, the character of the rocks forming this group has been spoken of. In Shelby the conditions are nearly the same. The beds become more siliceous towards the south, so that, on the Spencer line, the sandstones are heavier than in Henry county. A fine example of the mudstone character of this group may be seen in the exposures on the pike, in traveling from Hardinsville to Shelbyville, and soon after leaving the former place. For perhaps a mile or two, the road ascends on this horizon, and the side-cut is covered with the small and resisting fragments of stone and shale. The clay, and the clay soil also, is filled

with them, but no other stone is to be seen. They have all been dissolved, while the resisting shale has been left. Many are the places on the hill-sides and in the excavations where the roads have been constructed, and on the slopes worn with washing rains, where the alternations of limestone, sandstone and shale are exposed to view.

The soils over this series are usually soft and mellow, easy to cultivate, except for the steepness of the slopes. They are, perhaps, better in the dryer seasons than in the wetter. Corn and tobacco both do well on these soils, though they are not the best for wheat. In Shelby, some portions of these lands are based on broader ridges, and some on more level or undulating surfaces, than is usual, and when this is the case and they have received good care, they are among the best soils in the county. But too often they have been worn and gullied by heavy rains, year after year, until tracts, here and there, are turned out as useless for present cultivation, which are each year losing in value. The farms being generally small, the farmers too often claim that they can not afford to let fields lie idle for a period of years, to be improved by being put in grass, and that every season must give some return, be this great or small.

Upper Hudson Beds.—By reference to the map it will be seen that much the larger part of Shelby county is based upon the upper part of the Hudson period. The rocks which belong to this part of the series have something over three hundred feet of thickness, and are composed of limestones and shales. The lower half contains not nearly as much shale, between the layers of stone, as does the upper; indeed, rather more than the lower half is very largely made up of shells and corals. A large part of the shells are of one variety, the *orthis lynx*, and the greater number of the corals are of the small branching forms. These layers of rock were never densely compacted, and are of the kind denominated *shelly*. Under the ground, and on top also, they are easily acted on by wetting and drying, freezing and thawing, so that they crumble down, becoming soil. For this reason, one may often pass over a mile or more of the country, where these rocks are near the surface, without

seeing a stone. It is only in the creek beds that their character becomes discernible.

The lower part of these lie nearest the outcrops of the middle beds, follow their meanderings, and stretch to a number of miles in width across the county. The most level lands and the richest soils in Shelby are based on the lynx beds, though they are sometimes very thin on the ridges, or bordering on the rougher lands near some of the creeks in the southern part of the county.

The upper parts of these beds contain more solid layers of stone with much shale; some of the latter being sandy. At the top occasionally large isolated masses of stone are imbedded in the shales, and these latter are often left on the surface after the former have disintegrated. They are the coral *Columnaria alveolata*, and may be seen on Jeptha Knob and along the Oldham line. It is only in Long's precinct, and towards the top of the knob, that the above feature is present. The soils from this upper part are deep clays, readily acted upon by water, and, hence, easily washed. The large proportion of lime contained in them deprives them of that adhesive character, which is nearly always present in clays, and consequently they dry out rapidly and become friable.

I collected several specimens of soils for analysis from the Upper Hudson, in Shelby county, and the following is Dr. Peter's report upon them:

No. 2430 was virgin soil from the farm of John Davis, two miles east of Shelbyville. Timber: maple, walnut, yellow poplar, blue ash, white oak and white elm.

No. 2431 was surface soil from a field on the same farm, which had been cultivated for years but was then in grass.

No. 2432 was soil mixed to the depth of ten inches, from a field over twenty years in cultivation, on the farm of John Glen. This was near the last, and, presumably, originally the same character of soil and timber.

No. 2433 was virgin soil from the top of the Upper Hudson beds, on the south-western part of Jeptha Knob, some five miles south-east of Shelbyville- Timber: walnut, white and red oak, elm and honey locust.

2434 was soil from an old field, collected as near to 2433 as possible.

2435 was the subsoil of 2434, taken to the depth of from one foot to fourteen inches below the surface.

In each of these instances the original forest had been either completely cleared, or there were but few trees remaining. The old forest evidently held a greater number of species of trees than are now indicated.

COMPOSITION OF THESE SHELBY COUNTY SOILS.

(Dried at 212° F.)

Number	2430	2431	2432	2433	2434	2435
Organic and volatile matters	5.000	4.840	4.250	14.075	4.970	11.315
Alumina and iron and manganese oxides	9.044	8.852	9.494	16.158	9.490	14.380
Lime carbonate	.320	.645	.420	4.695	.720	25.245
Magnesia	.286	.322	.247	1.373	.389	.805
Phosphoric acid ($P_2 O_5$)	.268	.268	.211	.412	.365	.415
Potash ($K_2 O$), extracted by acids	.347	.418	.384	2.015	.591	1.772
Soda ($Na_2 O$), extracted by acids	.082	.061	.000	.000	.064	trace.
Water expelled at 380° F.	.515	.420	.365	.750	.280	.315
Sand and insoluble silicates	83.995	83.945	84.245	61.045	83.310	47.295
Total	99.857	99.771	99.616	100.523	100.179	101.542
Hygroscopic moisture	1.885	1.865	1.635	4.125	1.800	2.520
Potash in the insoluble silicates	1.773	1.385	1.429	2.131	1.509	1.677
Soda in the insoluble silicates	.473	.348	.382	.150	.241	.075
Rock fragments or concretions	3.500	.....	.....	8.200	.....	41.200
Character of the soil	virgin soil.	cultivated field.	cultivated field.	virgin soil.	old field soil.	subsoil.

"All of these soils contain more than the average proportions of essential mineral plant-food, and would be classed among the very fertile soils if all other conditions are favorable.

"Nos. 2433 and 2435 excel, especially, in their very large proportions of organic and volatile matters, phosphoric acid and potash. They are also quite calcareous, especially No. 2435, which approaches the marls in this respect. They contain more alumina and oxide of iron than any of the other soils, and a smaller quantity of sand and insoluble silicates. They are to be discounted, however, with the percentage of rocky fragments and fragments of fossil remains they contain."

In Volume III, Old Series, Kentucky Geological Reports, may be found other analyses of Shelby county soils and subsoils.

The presence of many beech trees over all the different groups of soils in Shelby county, and partially in Henry, is remarkable, as it has not been noticed in any other part of the State. In some of the best preserved tracts of forest, on the most favorable parts of the Upper Hudson, were seen within a small compass, sugar maple, blue ash, hackberry, Kentucky coffee-tree, wild cherry, red oak, box-elder, chinquapin oak, black walnut, white walnut, mulberry, black hickory and shell-bark hickory, an association typical of the best phosphatic soils of the State; but with them had grown numbers of yellow poplar and beech, species rarely seen on this group.

UPPER SILURIAN.

The rocks overlying the Hudson beds in this county are in small force, and appear only on the ridge east of Floyd's Fork in Long's precinct, and on the top of Jeptha Knob. In the first locality there is some forty feet of the formation left on the higher points, while, owing to the fact that, on Jeptha Knob, the surface is covered with soil and fragments of stone, it is impossible to tell how much remains. There is about one hundred feet above the highest point where the Upper Hudson is to be seen. The extreme upper portion is covered with the broken fragments of the Corniferous hornstone. It appears, therefore, probable that the full thickness of the Upper

Silurian, as visible in Oldham and Nelson, has been in position over this region.

The Clinton was present, but how thick it is impossible to say. The beds of the Niagara were opened here at one time, and the soft magnesium layers quarried and used for grave-stones and other purposes. A great deal of chert from the Upper Silurian is wasted over the slopes of the Knob and for some distance around it. One layer of rock was found to be so much like the cement rock largely used about Louisville, that a sample was taken for analysis, as was also a specimen of the soil on the upper portion of the Knob. The cement rock would seem to be Devonian. For comparison, the composition of the hydraulic stone from this locality, and an analysis of the Louisville cement rock, are given. It is probable that these layers were once the same, covering all the space between their present outcrops.

ANALYSES OF CEMENT ROCKS.

(Dried at 212° F.)

	Jeptha Knob rock	Jefferson county rock
Lime carbonate	41.612	50.430
Magnesia carbonate	25.010	18.670
Alumina and oxides of iron and manganese	6.378	2.930
Phosphoric acid ($P_2 O_5$)	.564	.060
Sulphuric acid $S O_3$	.960	1.580
Potash	not est.	.320
Soda	not est.	.130
Silica and insoluble silicates	25.521	25.780

There is a close resemblance in these specimens, and, while the Shelby county rock would probably make a good cement, it is doubtful if it would pay to manufacture it here. The amount of stripping required to reach it, the cost of fuel, and the transportation to market, are all against the locality.

The Upper Silurian soil from the top of the Knob shows the following composition :

COMPOSITION OF VIRGIN SOIL FROM JEPTHA KNOB, FIVE MILES EAST OF SHELBYVILLE. UPPER SILURIAN FORMATION.

(Dried at 212° F.)

Number in Laboratory Book.	2436
Organic and volatile matters	5.015
Alumina and iron and manganese oxides	6.590
Lime carbonate	.245
Magnesia	.250
Phosphoric acid $P_2 O_5$	.230
Potash ($K_2 O$), extracted by acids	.256
Soda ($Na_2 O$), extracted by acids	.000
Water expelled at 380° F.	.570
Sand and insoluble silicates	86 545
Total	99.701
Hygroscopic moisture	1.165
Potash in the insoluble silicates	1.401
Soda in the insoluble silicates	.383
Rock fragments or concretions	18.000

The character of the Upper Silurian will be farther treated in the notes on Oldham, as in that county it is more characteristic of the general surface, the Hudson beds forming but a small part of the surface.

DISTURBANCE.

Jeptha Knob has been mentioned as a remarkable elevation in the Central Kentucky region. The rocks which compose the upper part are a portion of those which, once continuous over the whole region, are now left isolated, many miles from the points where their full thickness and characteristics can be studied. The only feature in the Lower Silurian exposure of the State which is at all similar to this, is Burdett's Knob, in Garrard county. That is an isolated point, rising above the rest of the country, and cut off by a number of miles from the same formations which compose its upper part.

The summit of Jeptha is, by barometer, eleven hundred and eighty five feet above the level of the sea, and nearly four hundred feet higher than are the beds of the branches near its base.

There is a thickness of nearly 800 feet of rocks exhibited from the border of the Franklin county line to this elevation, a distance of six miles; and that means that, in part, that number of feet of material has been lost to the lower portion. That there should be three or four hundred feet remaining back at the heads of the drains leading from the county into Big Benson creek, is not remarkable, but there must be some cause for the preservation of the mass of this knob, where it is found to-day.

The reason of this remarkable preservation, as in other analogous cases, lies in the fact, that there was, in the uplift of the foundations of the State, a more extraordinary disturbance of the rocks in the immediate vicinity of this elevation, than took place over the surrounding country. Several fractures, extending to great depths, took place in all the rocks, and they dropped down, or were pushed up, in these places, leaving a basin-like depression by which the surrounding surfaces were, for a while, protected against erosion. They have long since lost that protection, and are now being rapidly eroded.

On the southern side, in and near the branch where the road over the Knob begins, the rocks may be seen tilted up on edge with a steep dip to the south-east. On going up the road, and a hundred feet or more above it, the rocks can again be ob served to have a steep dip. The lower rocks of the Lower and Middle Hudson will here be noticed, while those in the bed of the branch belong to the lynx beds of the Upper Hudson. There is evidently a displacement of at least two hundred feet of rocks, if they were on a level, or of three hundred, as they show themselves. On the north-west side, on the lands of the Messrs. Middleton, another line of disturbance is observable where the rocks dip to the north-west. The strike of these disturbances is, in each case, north-east and south-west, agreeing with the greater one passing through the State. These fractures are local, hardly affecting a line much greater than the base of the Knob.

The hard flinty rocks which cover part of the sides of the eminence, and which may be found in so many fields over the surrounding country, and filling the beds of the small branches extending from it, are merely the hard parts of layers of stone

now in place near the top, but once extended over the whole face of the county.

MINERAL SPRINGS.—There are several of these in the county, but none of them of much note. In the north-western part of the county there is a weak sulphur spring. In the valley of Six-mile creek, just below the mouth of Indian Fork, we find a spring of strong saline water which, at times only, has a sulphurous taste. This water has a local reputation for curing rheumati m. A sulphur spring flows from the rocks at Hardinsville, whose principal ingredients are, according to Dr. Owen (Vol. III, Old Series, page 53):

Free sulphuretted hydrogen.
Chloride of sodium (common salt).
Chloride of magnesium?
Bi-carbonate of magnesia.
Bi-carbonate of lime (small quantity).
Sulphate of soda, a trace.
Sulphate of magnesia, a trace.

MINERALS.—There is some little bog-iron ore in the soils of Shelby county. This is to be seen, in the soils and as gravel in the creeks, in the form of spherical lumps of small size. It is what is usually called "shot-iron ore." The quantity is small, and its formation is of comparatively recent date. It is deposited in wet and often gravelly places, where water, charged with solutions of iron, evaporated at or near the surface and precipitated its mineral ingredients. It, evidently, was derived from the rocks of the Clinton and the Corniferous, which were once deposited above the present surface.

Some calcite appears in the seams of the limestone and filling the cavities of fossil shells. Occasionally a geode is found, containing quartz crystals, but neither of these minerals is of any value. The sulphur waters are produced by the decomposition of small quantities of iron sulphide contained in some of the layers of rock.

ARCHÆOLOGY.—Not many places in Shelby county attest the former presence of a prehistoric people. On the farm of Jeptha Layson, near Shelbyville, numerous specimens of relics

have been found, among them a pipe carved into the image of a bird. On a farm near the Spencer county line, on the pike leading from Shelbyville to Taylorsville, used to be a small mound, around which quite a number of implements, made of flint and other stone, were plowed up. Mention is made in Collins' History of Kentucky of *an ancient fortification* as being on Jeptha Knob. "In form it is circular, with a double line of earthworks, four to eight feet high, and inclosing about three acres well overgrown with large trees. A supply of water flows from the interior. A few graves and relics are found near by. Over many of the fields over the county an occasional flint arrow or spear point is found."

APPENDIX A.

STATISTICS OF SHELBY COUNTY, COMPILED FROM THE UNITED STATES CENSUS REPORT OF 1880, THE STATE AUDITOR'S REPORT OF 1885, AND OTHER SOURCES.

1880.	Total population	16,813
1870.	Total population	15,733
1860.	Total population	16,433
1880.	White population	11,258
1870.	White population	10,350
1860.	White population	9,634
1880.	Colored population	5,555
1870.	Colored population	5,383
1860.	Colored population	6,799
Shelbyville population		2,393
Number of farms		1,625
Value of farms, buildings and fences		$8,915,107
Value of farm implements and machinery		$214,640
Value of live stock		$1,097,790
Cost of building and repairing fences, 1879		$50,279
Cost of fertilizers used, 1879		$2,858
Estimated value of all farm products		$1,308,988
Assessed valuation, real estate,		$5,517,845
Assessed valuation, personal property		$1,583,000
Assessed valuation, total, 1885		$7,320,230
Taxation, State, 1885		$41,859
Miles of railroad		33.61
Value of railroads in the county		$455,750
Miles of turnpikes		265
Average cost of turnpikes per mile		$1,500
Total cost of turnpikes in the county		$387,500
Value of horses and mares, 1885		$229,760
Value of mules and jennets, 1885		$76,415
Value of sheep, 1885		$47,235
Value of hogs, 1885		$39,780
Value of cattle, 1885		$233 520
Pounds of tobacco, 1885		3,325,990
Pounds of hemp, 1885		181,700
Tons of hay, 1885		6,175
Bushels of corn, 1885		882,310
Bushels of wheat, 1885		303,310
Acres of land, 1885		249,000
Average assessed value per acre, 1885		$21.12
Pupil children, 1885		5,508
Bonded debt, 1885		$52,000

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GEOLOGICAL SURVEY

OF KENTUCKY,

JOHN R. PROCTER, DIRECTOR.

REPORT

ON THE

GEOLOGY OF OLDHAM COUNTY

WITH MAP.

BY W. M. LINNEY.

STEREOTYPED FOR THE SURVEY BY JOHN D. WOODS, PUBLIC PRINTER AND BINDER.

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GEOLOGY OF OLDHAM COUNTY.

HISTORICAL, TOPOGRAPHICAL, ETC.

Oldham county, Kentucky, was named in honor of Col. William Oldham, a commander of the State militia, who fell during the engagement with the Indians at St. Clair's defeat, in 1791. It was formed in 1823 by legislative action, from parts of Jefferson, Shelby and Henry. Its original area has since been modified by the taking of part of its territory, in 1836, in the creation and formation of Trimble.

Oldham county is situated on the Ohio river, and near the center of the latter's flow along the northern border of the State. It lies opposite Clark county, Indiana, and is separated from it by the river, for eighteen miles, on the north and west; while Trimble county borders it on the north-east; Henry and Shelby on the east, and Shelby and Jefferson on the south. The general elevation of the county's surface is from three hundred and fifty to five hundred feet above the river, in the nature of a plateau, carved into by the valleys of a number of small streams, all of which empty into the Ohio. Patton's, Eighteen-mile, Dunbar's, Huckleberry and Pond creeks, reach the river within Oldham county. Harrod's creek rises in Henry, and, after running through nearly the center of Oldham, parallel with the Ohio, enters the latter in Jefferson county. Floyd's Fork of Salt river, having its extreme sources in Henry and Shelby, flows through the south-eastern part of Oldham into Jefferson, and thence south-west to its confluence with Salt river, in Bullitt county. It is thus to be seen that the direction of the drainage is towards the west and south-west. In this it agrees with the dip of the rocks of the county, which have a slant to the north west but fall off more rapidly towards the west.

None of the creeks are large enough to afford a continuous supply of water for running the few mills now situated on their banks, although such was the case at the time of the early settlement of the country. To the observer of the old mills, now

in ruins, which he finds situated on the banks of the small streams, it is quite evident that the water supply of the present day is far less than it must have been at the time when the county received its first white inhabitants. The vast—almost total—destruction of the forests, and the consequent stoppage of myriads of springs in their constant regular flow, have wrought wonderful changes in the creeks and branches. The drainage of the county is very good, there being but few wet places, and these susceptible of easy improvement.

Along the river front are a number of landings, and there is almost hourly steamboat communication with other points. The Short Line division of the Louisville and Nashville Railroad extends nearly centrally through Oldham, and at Lagrange, branches off to Lexington and to Cincinnati, furnishing to the citizens, many times a day, rapid transit and freight accommodations. There have been built in the county forty-seven and a half miles of turnpike, at a total cost of $159,425, the cost of construction, per mile, ranging from $1,650 to $5,000. A number of other roads should be, and probably will be, within a few years, macadamized.

Between the lines of drainage, a large part of the surface is comparatively level, there being, properly speaking, no hills in the county. Near the heads of the streams, however, as you go across the country, you meet with narrow valleys and steep descents, some of which are quite romantic, with their silver streams flowing at the feet of precipitous walls of rock. The wide and nearly level expanses between the streams are often beautiful. From some of the uplands in the Brownsboro and Goshen precincts, wide extended views may be had across the valley of the Ohio, and to the Silver hills of Indiana. These hills are the counterpart and continuation of the Knobs which surround the blue limestone region of Kentucky, and here, as at every other point, they rise high above the apparent level plain included in their boundary. Many of the views on the river are very beautiful; the frowning cliffs, the rounded hills, the graceful curves, make varying pictures which charm the eye of every lover of nature.

The area of the county is 116,000 acres, and the population in 1880 was 7,667. Lagrange, the county-town, is a place of

some business; still, its proximity to Louisville causes the loss of a good deal of its trade. The town has a population of about 700. An incorporated seminary is well patronized, but the common schools of the county, like those of most counties of the State, are below the standard.

Not a great deal has been done towards developing manufacturing interests. A few grist and saw mills, and a number of distilleries comprise all that would come under that head. The chief business of the county is farming, grazing and fruit-growing. Each of these are being carried on with more or less success. Several stations are located along the railroad, and a number of villages in other parts of the county, all of which add facilities to the citizens for buying needed articles or disposing of their produce.

GENERAL GEOLOGY.

The bedded rocks of Oldham are not of great thickness, but, like all other sections of deposits, they are not entirely without value and interest. They include portions of the Lower Silurian, Upper Silurian and Devonian, in the stratified beds, and the more recent Quaternary in the gravels, sands and soils of the bottoms along the Ohio river. The following section exhibits the thickness, and the division, as presented by the whole county:

Age.	Period.		Feet.	Feet.
Quaternary	Recent.	Alluvium		80
Devonian	Corniferous.	Limestone.		30
Upper Silurian	Niagara.	Niagara. Clinton. Medina.	59 41 30	130
Lower Silurian	Hudson.	Upper beds.		255
Total				495

HUDSON PERIOD.

The rocks of the Hudson period, of the Lower Silurian age, are the lowest strata exposed in Oldham county. At Cincinnati, and back of that city, there is an exposure of nearly eight hundred feet, and such is also the case in a number of the counties in Kentucky. But from Cincinnati the rocks all have a slant towards the west; this slant or dip is so considerable that, in coming down the Ohio, there is only the upper part, about two hundred and fifty-five feet, shown above low water, at the upper boundary of the county; and, at the lower line, this thickness has entirely disappeared under the river. The lowest rocks to be seen at the water front, at Cincinnati, are more than seven hundred feet under the river on the line between Oldham and Jefferson counties.

To any one familiar with the country, and not familiar with the great dips and displacements which are shown among some of the rocks, this appears very strange; yet this is but a gentle slope when compared with the features developed at many places on the earth. The inclination of the rocks, from the highest point in Central Kentucky to Louisville, is at least fourteen hundred feet. The whole series of rocks in this county conform to this inclination, so, we find them higher along the Henry county line than along the Ohio river.

The dip from Lagrange to the Jefferson county line on the river, is some three hundred and sixty feet, or about twenty-six and a half feet to the mile—the distance being something over thirteen miles. The dip due northward to the river is about three and one-half feet to the mile, while due west, to Harmony Landing, it is about twenty-five feet to the mile. The direction of the flow of the streams, and their parallelism, have been controlled by this general inclination of all the beds. This dip has been the cause of the general erosion of the surface of the country, and the present distribution of the various rocks and soils at the surface has also been produced by it.

UPPER HUDSON BEDS.—Of the three divisions of the Hudson Period, only the upper beds are to be seen. While making much the larger part of the surface in Henry and Shelby counties, where they are over three hundred feet thick, they

are, in Oldham, confined to the sides of the valleys of the streams except in part of the Ballardsville precinct, where they rise to the general level of the county. It has been stated that these beds rise two hundred and fifty-five feet above the Ohio river on the Carroll county line; but they are nowhere else to be found of so great a thickness, although every stream has cut its bed into them. Floyd's Fork and its tributaries have washed their beds to the depth of more than a hundred feet into these rocks. At the upper portion they have wide valleys on the Upper Hudson; but lower down these are narrower, because hemmed in and protected by a higher series of rocks. Harrod's creek has a much wider bottom on the Hudson beds near the Henry line, than it has on the side near the Jefferson boundary. In the latter locality it is restricted by the same causes which have modified the valley of Floyd's Fork.

The top of the Hudson is here, like in other parts of the State, made up of blue and grey limestones, with much shale between them. The heavy, solid layers of limestone are few, and their outcrops but rarely showing. One layer, noticed more particularly, on the Ohio river, is composed of quite a neat building stone. It consists largely of spiral shells (*Murchisonia bowdeni*, Safford), and is susceptible of a good polish. It was, at one time, extensively quarried beyond the Ohio river, and is now used in Trimble county, Kentucky. While making nice inside work for buildings, it is not a very durable stone when exposed to the atmospheric changes of our climate. A harder and more durable stone crops out here and there in the valley of Floyd's Fork, and is sometimes used for local structures, but it is rough-bedded and difficult to work.

The thinner limestones, and the shales, decompose easily, so that they are not often found in one and the same section, and the soils derived from them, holding a large proportion of lime, are quite friable. There are, near the extreme top, several heavy layers of blue earthy limestones, which break up into crumbling fragments. In the beds, these exhibit a concretionary mud structure. It may be said, that, with few exceptions, the exposures of the Upper Hudson strata, are here a series of crumbling rocks and shales, which liberate a great many fossils, while the residue is soon dissolved into clay. The fossils are

usually coated with hard clay, and, mixed with them, are small fragments of very much indurated whitish and yellowish clay.

In the deep hollows, near the Trimble county line, the rocks are better exposed, and their characters more conveniently studied. In many places large masses of corals have been thrown out by the breaking down of the softer rocks inclosing them, and they are found lying in profusion on the sides and at the foot of the slopes. At a few points near Lagrange, these fossils are imbedded in a sandy matrix, and have become partly or wholly silicified. This condition is particularly noticeable in a small branching coral, and in large specimens of the *Tetradium minus*. At one horizon there is a thin layer of hard brown chert, often containing silicified specimens of *Orthis lynx*, and a minute *Beyrichia*. This layer was, probably, continuous for a hundred miles or more, being seen in all the outcrops of this particular formation in the State.

Over the more aluminous beds, the forest growth was originally, to a large extent, beech. Where the limestones were near the surface, the predominant species was sugar maple; on the chert beds, the white oak outnumbered all others, while over the dark, rich and friable soils, blue ash, hackberry, wild cherry and chinquapin oak were the prevailing growth. Through all these were scattered a few black walnut, linns, yellow poplars, red oak, and but rarely other kinds.

Dr. Robert Peter, State Chemist, has made the following analyses of the Upper Hudson soils of Oldham county; they are copied from Vol. III, Old Series, of Kentucky Geological Reports, pages 368 to 371:

Number.	Virgin soil . .	Soil cultivated twenty years.	Subsoil . . . .
	734	735	736
Organic and volatile matter	4.778	3.001	2.643
Alumina	2.214	2 270	3.355
Oxide of iron	2.240	2.020	2.540
Carbonate of lime	.340	.170	.125
Magnesia	.328	.275	.365
Brown oxide of manganese	.172	.145	.145
Phosphoric acid	.251	.128	.112
Sulphuric acid	.067	.076	.050
Potash	.125	.111	.130
Soda	.027	.039	trace.
Sand and insoluble silicates	89.420	91.295	89.820
Loss	.038	.470	.715
Total	100.000	100.000	100.000

A comparison between the original soil, and the same after it had been cultivated for twenty years, shows a loss of more than twenty-seven per cent. of organic and volatile matters; a loss of fifty per cent. in carbonate of lime, and nearly as much in phosphoric acid. There is also a loss in potash There have been heavy drains upon this soil, and all of the ingredients most essential in a good soil have, in part, been removed. The subsoil is poorer in all the more important ingredients, with the exception of potash.

UPPER SILURIAN.

The strata which constitute the Upper Silurian formation in Oldham county are comprised in three of the groups, which, elsewhere, are much thicker than here. Neither of these exhibit the nearly similar character which clings to the beds of the Hudson period in their outcrops in Kentucky; and some difficulty has been experienced in bringing them into proper relation with the same groups as found in other States. There is room for future, more careful investigation of these beds and their fossil contents. Such an investigation might possibly

lead to some modification of the divisions, and solve divers scientific problems concerning their proper relation.

MEDINA.—At the maximum, there are nearly thirty feet of earthy, siliceous rocks, which lie immediately on the Hudson beds. These rocks are unevenly deposited, and in some places do not measure more than one-third of the above thickness. Where heaviest, they consist of some twelve or more layers, in the greater number of which, the material composing them is so loosely cemented that, after a short exposure to the weather, they crack and break into fragments which soon decompose into beds of sandy clay. The sand, when washed out from the clay, is of a dirty yellow color, and unlike that coming from any of the other rocks in the State. This fact has been of much service in determining the position of the shales into which this series resolves itself in some other counties.

In a freshly opened cut, the best layers appear massive and as if they would be very valuable as building material. Even-bedded in places, and readily quarried, they have often been tried with the general result, viz.: that they soon break down into a worthless mass, often to the ruin of structures erected over them. Such is their character in a number of counties in Kentucky, Indiana and Ohio. The only exception to this rule, in the State, which has come under my observation, is in the eastern part of Oldham county, and around Lagrange, where one or two layers have proven to be quite a valuable and durable stone. Whether these are interpolated beds, or whether this is a local phase of some of the layers, I do not know; perhaps the former, as their presence is marked by heavier bedding of the strata.

Some of the layers possess hydraulic properties, and could be used in the manufacture of cement. Others, owing to the very fine nature of the silicious ingredient contained in them, furnish an admirable polishing material. Several of them, when properly prepared, offer a very fine material for taking the impression of medals, coins and other designs.

Mr. Goldsboro, of Lagrange, has made a great number of experiments for the above purposes. It is to be hoped that success may attend him, and a prosperous business be the result.

The exposures of the Medina are very restricted. The narrow margin between the Hudson and the Clinton beds marks the limits, and often this can only be determined by a sandy soil, sometimes almost barren, and always poor. The belt was originally covered with black hickory, red maple, white oak, yellow poplar, scarlet oak, post oak, beech and black oak.

CLINTON.—It is not always an easy matter, in Kentucky, to define the limits of the Clinton. There are so many changes in the beds that they prove widely different in different counties, and sometimes even in the same county. The same layer will thicken or become thinner, or even disappear entirely in the course of a few miles. There is but little similarity in the rocks, when examined on opposite sides of the Lower Silurian exposures in the State.

The lower layer in this county is often absent, but, when in place, it is a limestone ranging from a few inches to three feet in thickness. Sometimes the color is of a reddish cast. The fossils, of which it holds quite a number, are all silicified and different from those of any of the other strata. A fine-celled chain coral (a variety of *Halysites catenulatus*), and a small horn-shaped coral which Mr. Davis has named *Cyathaxonia gainesi*, are the most common forms. Locally, there is much calcite in this bed, often of a pinkish tinge. The stone is irregularly bedded, and breaks into rough, irregular masses. In Kentucky it is confined to Oldham and Jefferson counties, but it also occurs in Clark county, Indiana.

Two or three layers of magnesian limestone rest upon the limestone bed, where it is present. When it is absent, they repose directly on the sandy layers of the Medina. Above the magnesian beds are about fifteen feet of blue shales, holding a few thin sandy flagstones, with impressions of several species of plants imbedded in them. These shales are often quite thin, sometimes too thin to be seen. Over the shales there are some eight feet of yellow magnesian limestones, in courses from four to twelve inches in thickness, on which rests a massive rock here and there approaching to twenty feet in its bedding, but in other places reduced to three or four feet, or even less.

This latter is a very remarkable layer. It is rough and rug-

ged, wherever seen, and, where fully exposed in its greatest thickness, stands out like a great wall in ruins, usually rent and fissured, but sometimes isolated. Often, the great blocks, undermined from their support, have fallen down on the slopes, or plunged down into the valley far below. The rock is open and porous, from the leaching out of the fossil contents. The cavities near the surface are large, and the interior is honey-combed by smaller ones.

This cavernous feature allows the layer to imbibe and hold large quantities of water, and thus has become the great water-bearer of a large section of country. Many fine springs flow from its base. The clay shales below prevent the downward passage of water, consequently it has to escape along the surfaces. Even when this layer is not visible, its presence under the surface can be determined by a great number of small sinks on top of the ground. The earthy and other soluble constituents of other rocks are carried down through the interstices, and leached away. These sink-holes have no surface-drainage. The springs at Lagrange, and at Anita, have their reservoirs in this layer, though it is comparatively thin at these points.

This layer is not local in its horizontal extent. It is the source of the Yellow Springs, in Ohio; may be seen at numerous places in Indiana, and extends more or less through Carroll, Trimble, Oldham, Jefferson, Bullitt and Nelson counties, in Kentucky, having the local name of fire-rock. It does not burn into lime easily, its open character allowing a diffusion and escape of heat; and for this reason it is difficult to quarry or to blast in digging wells, the gases from explosives escaping through the numerous vents.

The cherty segregations, which form such a remarkable feature of the Clinton in Bath, Fleming, Lewis and some other counties, are entirely absent in Oldham. Nothing approaching the iron ore beds of the above counties can here be seen, and the accompanying fossils are also wanting.

On parts of Harrod's creek, as well as on Eighteen-mile creek, the great castellated rock is a very distinguishing feature. The valleys are here quite romantic. The limits of the Clinton outcrops are rather constricted, being often but a few

yards wide; they also present few marks distinguishing it from the Niagara, unless closely examined.

NIAGARA.—Named from its occurrence at Niagara Falls, this, in some of the States, is a great and important group of rocks. Thinning out towards the south, it loses a large part of its volume, and, on the surface, is of very limited range. In Oldham, however, it covers more of the surface of the county than all the others combined. It is composed of thick beds of limestone, a large proportion of which are magnesia, and, usually, of a bed of blue clay shales. The shales are, at the base, resting on the cavernous bed of the Clinton. In this State, the Niagara group is very irregular in its bedding. In Bath, Fleming and Lewis counties it is a shale bed a hundred feet thick, with very little solid rock in it. In Marion and Nelson the shale is thirty-five feet in depth; but in Oldham its maximum is fifteen feet, and sometimes it is entirely absent. The shale consists of hardened clay, arranged in thin sheets, and varying in color, but most frequently it is decomposed to a blue clay.

The limestones of this group are some forty-four feet thick, in the county, but in no one exposure can they all be seen at once. The lower layers are regular, even-bedded building stones of good quality, ranging from six to twenty-two inches in thickness in many places, where desirable quarries might be opened. Above the last bed there are several others composed largely of carbonate of lime. The fossils imbedded in them are very numerous, and all silicified. There is much chert in these layers, and some of the masses are quite large. Rarely are these beds found in place; they break down where exposed, leaving heavy beds of red clay, with the chert and fossils imbedded in them. Often the surface of the ground is rough with the accumulations of the chert and fossils.

One of the beds has a layer of evenly bedded chert, while another is locally studded with small geodes, some of which, when broken, exhibit beautiful druses of quartz crystals on a base of chalcedony. These seem to have been formed in cavities left by the leaching away of lime fossils. Here and there you come across siliceous casts of *Pentamarus oblongus*, a large shell, in which the hinge line and lateral extremities are sharply defined in the cast.

The level expanses between the drainage lines are all based on the Niagara, and the presence over much of them, of the chert and clay, shows that the horizon of these rocks to have been pretty evenly acted upon in the erosion of the region. Above the chert beds I found a number of feet of soft earthy magnesian limestones, nearly destitute of fossils. One of the strata was, locally, near five feet thick, but not a valuable stone. At the top are several thin layers of common limestone, inclosing many species of horn-shaped and cylindrical fossil corals, usually but poorly preserved.

The quartz which forms the chert, and the silicified corals and shells of the Niagara, here, were evidently deposited in this horizon long after the concentration of the material composing them, and it seems evident, from a number of phases exhibited in both, that the chert in the Clinton beds of Bath, Fleming and other counties of Eastern Kentucky, and that of the Niagara in Oldham, Shelby, etc., had the same origin, and were deposited at the same time.

The heavy beds of the Niagara are in place in Highland county, Ohio, but nowhere in a line south of that locality; they rather extend westward into Indiana, and thence into Kentucky, being found in Carroll, Trimble, Oldham, Henry, Shelby, Jefferson, Bullitt and Nelson, and, judging from the general line of outcrops and the remains of the chert beds, they must have been spread over at least part of Bracken, Pendleton, Harrison, Scott, Franklin, Anderson and Washington, and all of Campbell, Kenton, Boone, Grant, Gallatin, Owen and Spencer counties. From this territory they probably followed a south-west line, now hid by overlying rocks, through Western Kentucky to where the equivalent beds appear in West Tennessee.

The Niagara in this county has a large number of species of trees growing over it, and the general flora is quite numerous. Where flat and damp, beech, sweet gum, red maple and scarlet oak prevail. Where the rocks are near the surface, sugar maple and the hickories are flourishing. On the level uplands I found sassafras, walnut, various oaks, black gum, black locust and large yellow poplar. Red cedar grows at some places on the cliffs of Eighteen-mile creek, and, what is most

rare in Kentucky, quantities of chestnuts are growing on the lower part of this group.

The forests have not been so largely destroyed in Oldham as in many of the counties based on the Lower Silurian in Central Kentucky; but the greater part of the *valuable* trees of the remaining woodlands have been removed. There is some good white oak standing here and there. In a number of localities, where the soils have become greatly exhausted by long cultivation, and no further returns can be expected from them, they have been left to themselves. Over these, in a short time, grow a wilderness of young trees, shrubs and vines, and within the space of a few yards may be found poplars, sycamores, ash, sassafras, elms, black gums, sumacs, honey locusts, black locusts and red-bud, and near lines of woods, where the heavier seed can be scattered, red oaks, black oaks, white oaks, walnuts, hickories, and sometimes beeches.

The following analyses represent the character of the Upper Silurian soils. No. 1 is a sample of the Medina soil of Oldham county, and No. 2 the average of five soils and subsoils from the Upper Silurian of the adjoining county of Jefferson :

	No. 1	No. 2
Organic and volatile matters	2.537	5.548
Alumina	1.120	
Oxide of iron	2.265	9.771
Oxide of manganese	.072	
Carbonate of lime	.239	.279
Magnesia	.233	.249
Phosphoric acid ($P_2 O_5$)	.107	.223
Sulphuric acid	.079	. . . . .
Potash	.075	.215
Soda	.056	. . . . .
Silica	92.746	84.269
Loss	.112	. . . . .
Total	100.000	100.000

DEVONIAN.

Corniferous.—The rocks of the Devonian age, lying beneath the black slate of Kentucky, have all been included in their description, as being of the Corniferous period. The beds are in small force, wherever seen in the State; but they are well

marked by their peculiar character. The upper part, in some places, evidently includes a small portion of the Hamilton period, but it has been deemed best not to try to separate them in these reports. Nothing could be gained by such a course; it would only tend to confuse the majority of persons reading the descriptions.

About thirty feet of the Corniferous appears on the ridge between the Ohio river and Harrod's creek, and a less thickness between the latter and Eighteen-mile creek; but in both cases they are but little removed from the line of Jefferson county. The layers at the base are heavy-bedded and usually marked with heavy segregations of hornstone, and the greater number of fossils are silicified. Others of the layers are carbonate of lime of a grey color; while near the top there are some thin earthy limestones, and immediately at the summit several feet of light-colored stone. The latter is the cement rock, so largely used around the falls of the Ohio, in making hydraulic lime. All of the section is generally covered with deep soils and clays, and no quarries have been opened into them. Some of the Corniferous layers, when free from cherty matter, are very good building stones. But the chert is an important factor in their destruction, and where this material is present the rocks are rugged or broken down, while the cherty matter and the weathered fossils lie buried in the clay, or scattered over the surface. The decomposition of the limestones gives a rich dark, red clay, which is peculiar to this group.

The destruction of these rocks is more rapid and more irregular than that of the Niagara below, and the surface is, therefore, not so level over them. The iron which they contain assists in their decomposition, and gives the color to the beds derived from them. Elsewhere, the outcrop of the Corniferous has been such a narrow rim that it was inconvenient to make an exhibit of it on the maps, but in Oldham it is of sufficient extent to outline its exposures.

The soils derived from these rocks are very desirable, and in this county some fine farming lands are situated over them. Their general character may be seen from the following table, which is an average of fifteen samples taken from over the formation:

Organic and volatile matters	5.071
Alumina and iron and manganese oxides	9.060
Lime carbonate	.469
Magnesia	.626
Phosphoric acid ($P_2 O_5$)	.279
Potash extracted by acids	.343
Sand and insoluble silicates	85.517

Very large yellow poplars and black walnuts are growing over these soils, while sugar maple, beech, linn, buckeye and wild cherry, represent the bulk of the growth. The trees, on an average, are of larger size than those which grow on the Upper Silurian soils. The deeper clays and soils, with a larger proportion of plant-forming minerals, and the better drainage, all favored a more rapid and vigorous growth.

QUATERNARY.

This is the most recent of the Geological ages, and includes the present time. The bottom lands extending along the Ohio river, and the islands situated in it, belong to this formation, they having been produced by the same causes as those now in operation. There are several extensive bottoms in Oldham, and the two islands along the river, here, belong to the county.

These alluvial lands are composed of bowlders, gravels, sands, soils and other material, which have been brought down the river by its currents, and deposited in their present places. They are, therefore, fragments of every thing which the river receives from the land, either borne on the surface or pushed onward by the force of the water. Dead leaves, logs of wood, pieces of coal, bones of animals, fish and birds, and other substances, have found a lodgment in them.

Usually there are two, but occasionally may be found three of those bottoms, arranged like terraces, one above the other. Some geologists assume that the bed of the Ohio was once higher than it is now, and that it had cut a channel some one hundred and fifty feet lower than that of the present day; that then the river ran through the present site of the city of Louisville, and not over the falls as now; that it was afterwards filled up and began to cut its present channel.

The upper bottoms were evidently formed when the river ran

at a higher level than it occupies to-day. The valley, from hill to hill, was covered by the floods, and the currents moved from side to side, depositing, in favorable places, the detritus gathered from its whole drainage basin. Perhaps for many years the river flowed at nearly the same elevation; then, by the removal of some obstruction, it sank deeper into its bed, the channel became more restricted, yet wide enough to allow the making of other bottoms lower than the first. These operations can be seen on all streams, whether large or small.

The upper and lower terraces are composed of the same materials, but the former, now never overflowed, receive no enriching material, and are, besides, subjected to a leaching away of their soluble contents, consequently, contain less plant-making food than the lower ones. Beds of sand and gravel are distinctly stratified in some parts of these river deposits, and in them are many small bowlders—rocks of foreign origin—which have been brought into the river from north of the Ohio.

The soils on these bottoms are a fine loam, and, where well-drained, remarkably productive. They are, as a general rule, naturally of easy drainage. The fine sandy loam, the beds of sand and gravel all allowing the water to pass readily through, soon dry out. In a few places there are beds of clay which do not allow the water to escape immediately, making it necessary to ditch them. Rarely a bed of hard-pan has been formed, and this acts as an impervious bottom to swampy places.

The lower bottoms are, in part, overflowed by the highest freshets in the river, and then receive a new coating of sediment. Incipient bottoms can be seen now, forming at a lower level, and, in time, they may, perhaps, become like the ones now existing. The bottom lands used to hold a dense growth of forest trees, largely beech, but they have all been cleared, and over them are now fine fields and meadows. The more sandy loams, very near the river, are often given to melon culture.

SOILS AND FERTILIZATION.

It has been shown that the rocks of Oldham county, while not having a great vertical range, are composed of materials

varying greatly in kind and proportion. The soils derived from these various combinations of rock elements, are necessarily very unlike, and present various types of association of the elements which furnish to plants their natural sustenance. From the rich sandy loams of the bottoms, and the warm calcareous clays of the Upper Hudson, through the red clays of the Corniferous, and the lighter ones of the Clinton and Niagara, to the thin sandy soils of the Medina, there is well-marked variety in color and producing quality. Some are yet rich in those matters which a constant forest growth of many years has added to them, while others have been robbed of every atom of fertility which a poor return of exhaustive crops could wrench away.

Much has been done in Kentucky, by the State Chemist, in the way of analyzing the many characters of soil belonging to the various groups, and the State has published and distributed the results of these investigations. The inestimable value of all this work is before the people, and it is for them to make proper application of the knowledge gained. We now know a great deal about the character and constituents of the soils over the many groups of the State, and about the various proportions of the elements composing them. This is a grand starting point.

We know that the soils of our bottom lands have been derived from the comminuted fragments of all the rocks and shales, to the very head of the rivers; and that all the other soils have come from the breaking down and the disintegration of the stratified deposits now in place, or which recently overlaid them; also, that the elements of vegetable food existed, only in other forms and combinations, in the hard layers. Each layer of rock was formed under somewhat distinctive circumstances, and contains minerals in very differing proportions and unlike chemical relations; and in the dissolution of these layers, their particles, especially on slopes, become intimately mixed. These combinations sometimes give quite a number of varieties of soils; but they are always very limited in their extent. The soils from any one of the geological formations show very constant characters, and the belts, as traced out on the colored maps of the counties, will be found to have, origin-

ally, had soils of nearly the same average constituents, though followed from county to county through the State.

The art of the chemist can not give to the agriculturist all the knowledge he may wish to possess, neither can the eye, no matter how well trained, detect in the color or condition of soils, certain facts which it is desirable to know. But, with a knowledge of the constituents essential to a good soil, the practical observer can usually detect the wanting ingredients in his fields, and learn how to restore them. Does a soil begin to lose its dark coloring matter, and, each year, become more difficult to cultivate, because of its greater compactness, then he should know that there is a loss of organic and volatile matters, and that these things need be supplied. Stable manure will do it, but the farm never produces enough for that purpose. The only practical way, then, is to turn under the heaviest crops of grass, grain, clover, weeds, etc., that can be produced on the land.

Do the crops of grain begin to fail, then there is probably a deficiency of phosphoric acid, and the plow must go to the subsoil for more, if it be there, or bone-dust or other phosphates must be put upon the fields. Do the root crops decrease and the tobacco cease to yield a fair return, then the potash has been removed, or it is not present in an assimilating form, and again, the subsoil must be made to give it up, or some other source must be sought.

Lime has the property of making soils lighter, and, consequently, facilitating its drainage. It also has the effect of reducing, by chemical changes, the potash, soda, magnesia and phosphates, contained in the soil in insoluble forms, to a soluble condition, thus increasing the amount of available plant-food. Salt has a like effect, as has, also, the decomposition of organic matter, when soiling crops are buried by the plow. Another resolvent of the earth materials is land-plaster, sulphate of lime, the sulphuric acid given out reducing several elements and combinations.

An observing farmer, looking over his growing crops, determines, without effort, where the soil is most productive, and learns that, in certain places, it is best adapted to the growth of certain grains or other plants; and, if he loves his calling,

he should, by a series of experiments, attempt to produce a uniform fertility in his fields and pasture, and thus prepare them to give, with thorough tillage, the largest returns. A knowledge of the basic elements of good soils, and their due proportions, a few well studied experiments in subsoiling, and the application of fertilizers, will put such a man in possession of a number of facts which he alone can ascertain. He could thus obtain a better knowledge of himself, as well as of his farm.

It is true that these things require some measure of thought, some intelligent labor, and some expense ; but in all the economic relations of life, there is no one thing of greater value than the possession of that intelligence which enables a farmer to attain a knowledge of the character of his lands, and teaches him how to preserve the richness of his soils, and, at the same time, to garner greater crops than the same soils had produced before.

In the exhaustion of so many lands in Kentucky, by criminal carelessness, ignorant clearing or excessive cultivation, a great wrong has been committed. These lands belong to future generations as much as they do to the present, or did to the past, and it is for us to repair the wrong, by giving them constant care, intelligent usage, and, if need be, return to them the elements of which they have been robbed ; and thus, in time, restore them, if not to their original fertility, at least to a condition greatly superior to what it is at present.

The improvement of their fields and the knowledge of how it may be done, is, by many so-called farmers, looked upon as some great mystery, or as entailing an endless expense. The spending of a few dollars for commercial fertilizers is viewed by them as a waste of both time and money. The deliberate growing of a heavy crop of clover for the purpose of turning it under the ground to rot, seems to them like building a house, and, when completed, setting it on fire and burning it down. With all that has been taught on this subject, we have few who make a practice of improving the soil.

The essential elements are few, other than those which soils always contain. Lime, magnesia, phosphoric acid, sulphuric acid, nitrogen, potash, soda and organic matters, are requisite,

at least in certain quantities, in every soil to make it good. All of our soils, as far as examined, show that, even where apparently exhausted, they still contain a sufficient supply of lime, soda, potash, magnesia and sulphuric acid, and that only in some cases, a supply not furnishable by the earth, of nitrogen, organic matters and phosphoric acid is needed.

Over our Trenton and Hudson areas, a large number, perhaps all, of the layers of limestone, yield to the soils a more than average quantity of phosphoric acid, the rocks often containing more than ten per cent. of phosphate of lime. Many of the soils are especially rich in phosphates, and would not be improved by any further application of them. From this fact it may be accepted as an established rule, that, with rare exceptions, the application of bone dust, bone meal and other phosphates, is of no value over the blue limestone or blue-grass soils. Thousands of dollars have been thrown away from a want of knowledge of these facts. In the few cases where those ingredients are probably needed, an experiment lasting through but a single season, would demonstrate it; and such an experiment could be made with little effort or expense.

The organic matters which compose the manures of the stable and fowl-yards, where properly saved under shelter, contain nitrogen in considerable quantity, as well as certain proportions of all the elements required for the crops from which they have been derived. Free applications of nitrogen give the soil every thing that is needed to enrich it, even to the organic matters which promote porosity; and, with it, facilitate the admission of air, and the drainage of excess of water. The great want of the long cultivated fields, on the Lower Silurian soils, is simply organic matter.

It would thus follow, that to restore the worn lands, situated purely on the beds of the Hudson and Trenton periods, all that is required is to give them plenty of organic matter. Every experiment and every recorded fact demonstrate to us, that in no way can this be done so easily, so thoroughly, and so satisfactorily, as by growing great crops of clover, and burying them beneath the surface. Clover sends its roots deep into the earth, and lifts up to the surface those food elements which lie in the subsoils and under-clays. They are relieved of their

unassimilating forms, and reduced to the form of fertilizing matter. Their growing action is, to pump up from the lower reservoirs the lime and potash, the phosphoric acid and soda, and to expose them to the light of the sun, and to the influence of the atmospheric powers. Their foliage gathering the rains and the dews, and drinking the nitrogen from the air, holds a wealth of vegetable food, which, returned to the earth, is soon in condition to be taken up by other crops. It is a process of manufacturing and preparing the very essentials which make a good soil.

The mechanical conditions produced where large soiling crops have been given back to the earth, are all that can be desired. The labor of cultivating is lessened more than one half, nitrogen finds its way into the loose earth, rains filter away beneath, the warm air circulates among the roots of thriving plants, and a bounteous crop pays for all the toil and time expended.

It is fortunate that the limits of the Medina are so narrow in Kentucky. The soils over it are not retentive of organic and volatile matters, and the other plant-sustaining minerals are carried out by the water of ever-recurring rains. The clays from the Clinton and the Niagara beds work down over them, and organic matters reach them from the same source. These materials help to improve them, so that it is rare to see more than an acre or two, on a whole farm, with an unmixed soil of this kind. The few eye-sores which they make had better be hidden, and a larger return might be secured than by any other means, by planting them in black locust or some other rapid growing tree.

The Clinton soils are here so mixed with the Niagara, and the characters of the two are so similar, that I shall refer to them only as Upper Silurian soils. These are the most important lands in Oldham county, for they cover the larger part of the surface. Being clay soils, derived from rocks differing widely from those of the Lower Silurian, they are less rich and warm than the calcareous loams of the latter, and ordinary vegetable life is less rapid in growth over them.

The Upper Silurian here is largely on flat-topped ridges, and the soils have very little matter derived from any higher source than the destruction of the beds of the period. The magnesian

layers are often called "freestone," and, while the layers of the Medina approach that character, this is not the case with any of the Clinton or Niagara. With the exception of a few layers, which have been mentioned under the head of Geology, they are magnesian limestones, containing both lime and magnesia, often in nearly equal proportions.

When first cleared, these soils produce fine crops, and this condition holds out longer than would be the case on more rolling lands. The slow drainage of the level fields prevents that leaching and washing to which hill-sides are so liable. But in a few years there is a regular diminution in their power to produce profitable returns. The lands then decrease in value, until, in many cases, fields are left entirely uncultivated, and given over to the destructive action of the elements, and to the growth of such plants as can extort a living from the half sterile acres.

In these soils there is stored up ample lime and magnesia, with a wealth of potash; but there is a lack of available phosphoric acid, and the organic matters have been carried away. Such soils are comparatively easy of renovation by the application of phosphate of lime, and the growing and turning under of such crops as they will produce. Blue-grass does not grow well over them, rye only gives a limited quantity of vegetable matter, but clover is well adapted to almost all soils, and to it we must look for all the qualities that will restore exhausted fertility

On some of the roads, on the Upper Silurian, which have been macadamized, the material for their construction has, for short distances, been obtained from the beds of the streams which have been worn down into the Lower Silurian. These materials, composed largely of fragments of the limestones of the valleys, are rich in phosphate of lime, and, when ground into dust by the vehicles passing over them, this dust is, by the washing of rains and by the winds, carried over the surrounding soils, and, in a short time, the blue-grass covers the tracts with a fine sod. The wasting soils on several of the hill-sides, and the accumulations of matter in many of the hollows, and in the beds of the creeks, would be a valuable fertilizing material if hauled and spread over some of the Upper Silurian soils in close proximity to the valleys.

Many acres of these lands have been cultivated until no longer profitable, and are now growing up in thickets of bushes, briers and tangled vines. If these fields were set out in orchards, with clover and rye sown between the trees, not many years would be required to make them valuable, provided they received proper attention.

Several of the more intelligent and progressive farmers of the county have, for some years, been using phosphate of lime, in the form of bone-meal, on their wheat crops, and it has been repeatedly demonstrated that the application of one hundred and fifty pounds of bone meal to the acre (the usual amount), increases the yield of that cereal, on an average, one hundred per cent., or from ten to twelve bushels per acre to twenty and thirty. This statement does not apply to one field or one farm, but to many, situated in various parts of the county; and, even at this rate of increase, the phosphate is not exhausted in a single crop, but its good effects are perceptible in successive crops of corn or grass.

By the aid of soiling crops, and the use of liberal supplies of phosphates, these lands could be made as desirable as any purely agricultural soils in the State. They sometimes need deeper culture than they receive, and, possibly, drainage would improve them very much. High above the drainage lines, affording beautiful views from many points, and being level enough for easy culture, these lands recommend themselves to the intelligent, as fit for homes of health and happiness.

The soils over the Corniferous limestones are naturally better than those of the Upper Silurian, though both are derived, in large part, from the magnesian limestones. The Corniferous is richer in phosphoric acid; the rather rapid destruction of the rocks, owing to the presence of more iron, gives depth to the soil; and the iron, acting chemically on the clays, prepares their elements more rapidly for plant food. Added to these reasons is another, a very important factor: the deeper soils, in time, have grown more plant life, and the leaf mold and rotton roots have greatly added to the amount of organic matter in them.

As a general rule, the Corniferous soils are better drained than the Upper Silurian, because the lands are more rolling;

they are dryer for the same reason. It is often quite a number of feet, through the soils and under-clays, to the rocks below. A few places over them are too wet, and this occurs where the cement rock is near the surface. This rock is close and compact, and in its decomposition gives a whitish clay, through which the water works with difficulty. Such places, besides drainage, would need a plentiful supply of organic matter, and the addition, perhaps, of some phosphatic material.

The alluvial bottoms on the Ohio river belong to a different class of soils from those already spoken of. They are the finely mixed constituents of all the soils and rocks which are washed by the river and its tributaries, and all the elements in them are, thereby, brought into intimate relation. They are rarely wanting in any of the matters necessary to impart character to a fertile soil. The sands and clays of the coal measures, and of the Subcarboniferous; the lime from the St. Louis; the mixed ingredients of the Upper Silurian and of the Corniferous; the phosphates from the Lower Silurian; the washings of the drift deposits north of the beautiful river, and the leaves from a thousand hills, are all gathered together. At times, some of the lower bottoms are top-dressed by the sediment which high rises have left over them.

These bottoms are rich, and seldom, if ever, fail in rewarding their owners with plenteous crops. Being fine for grass, and unexcelled for corn, they are cultivated year after year; and, too often, the entire crops removed. It is no wonder, then, that some of them—the higher ones—show signs of a loss of their old fertility, while poor spots begin to form over them. Rarely are they, in places, too wet, and require to be ditched. In these places, back furrowing would be better than level culture, and could be resorted to with great benefit. The removal of large crops of hay is a serious drawback to the preservation of the richness of these valuable lands.

FRUIT-GROWING.

While few counties in the State have given any particular attention to horticulture, Oldham has a large number of fruit-growers. Nearly every farm is supplied with fruits of some

description. Many fine orchards are in full bearing, and others, of large size, are being put out by those who have already been successful, or anticipate following fruit-culture in the future. Like in all other branches of business, there is often a want of labor and judgment in the care of orchards; but, on the other hand, some of them are kept in admirable order.

The uplands are high above the lines of the creeks and river, and their proximity to the Ohio Valley, with the nature of the soil and nearness to market by both river and railroad, all combine to make this county a favorable locality for the grower of fruits. The locations are measurably protected from the action of destructive frosts, by the immense fogs which at times rise from the river; and they are benefited by the constant evaporation of the water from the same source.

Not much has been done with vines and small fruits. Grapes do well under cultivation, and the county looks almost like the natural home of the wild grapes, so prolific are they. Budded peaches are liable to be killed, but seedlings do well. Apples, pears and cherries seem to succeed as well as on any soils in the State. Some of the growers ship large quantities of these to market, in the green stage; great numbers are distilled into brandy, while the supply for home use is always bounteous.

The best orchards, and consequently the best results, are found on the soils of the Niagara and the Corniferous. The former are preferable, as the trees do not overgrow themselves, their colder nature holding back the rising of the sap and the blossoming of the trees until somewhat later in the season; and the lands are cheaper in price. Many varieties of apples have been tried with varying success. The experience of one orchardist is sometimes at variance with that of another.

The Ben Davis or New York Pippin has the reputation of being the most profitable to the raiser. The Maiden's Blush and the Yellow Bell rank very high. The Northern Spy is not a regular bearer, but sells readily. The Baldwin has not been much cultivated, but it grows well and produces fine fruit. The Little Romanite is a fine bearer, prolific in fruit every year, sells fairly, and is a good keeper. The Wine Sap is a favorite with some growers. The Roman Beauty, as well as an im-

proved Genet, are considered very fair apples. The Rambo and the Early Harvest are also grown with fair success. The Bell Flower does not often produce fruit, but the Hoop apple, while not of great value, both bears and keeps well. The Maiden's Blush ranks highest, during its season. Among pears, the Seckel and Flemish Beauty are highly prized, owing to the large returns they give. The Bartlett is much thought of, but the blight soon destroys the trees.

In time, and with proper attention, great returns may be expected by the fruit-growers of this county.

WASTE BEDS.

Lying on the uplands, mixed with the soils of the slopes, and forming part of the loose and broken materials which strew the creek bottoms, may be seen great quantities of hard flinty rocks, and sometimes pieces of clear quartz. All these are the harder portions of layers of rock which were once general over the county. The masses which held these fragments have been broken down, their particles separated and carried away, while the hard resistant fragments were left behind. Some of them are hornstone, others chert, and still others chalcedony or quartz. Here and there the hornstone has been jasperized. Some are replacements of fossils, others of fossil casts. With all these may be found geodes, or their fragments, and smooth, round pebbles of variously colored quartz. The geodes and the pebbles have come from rocks which are no longer to be found in Oldham, but must be looked for among the higher distant hills, and among the massive foundations of the Carboniferous formation.

Standing on any of the upper points, between Harrod's creek and the Ohio river, and looking across the valley of the Ohio, to the Silver and other hills, at whose feet masses of black slate and Subcarboniferous rocks are reared like mountains above the plain, one can not doubt but that there was a time when these same hills covered the whole valley, and were continuous far to the south; and when he picks up fragments of Waverly sandstone, and the conglomerate pebbles, he must believe that here the coal measures, with all their wealth of carbon, once

reared their masses far above the present surface of Oldham county.

MINERALS

Oldham county contains no minerals of economic value. Calcite, or crystalized carbonate of lime, may be found in little nests in some of the limestones, perhaps cementing old fractures in them. The hard fragments of rocks over the county all belong to some form or other of quartz, and this is some times beautifully crystalized, in the Niagara layers. Some little shot-iron ore is contained in the soils, and in the Corniferous waste may be found small branching stems of corals, which have been replaced with iron. Occasionally there are some pyrites of iron in the bedded rocks, which, while assisting in their decomposition, cause the finder of these glittering particles to indulge in dreams of gold.

ROAD MATERIAL.

There is a plentiful supply of material all over the county, for making the best of roads. A number of layers of limestone, which outcrop all along the valleys, are readily quarried and make first rate turnpikes. The Clinton, Niagara and Corniferous, all could furnish an abundance of stone for this purpose, and they are nearly everywhere of ready access, besides being very durable. Because the last named are tough-breaking stones, they are too often avoided by the road-builders, and the sandy, poor and easily crushed layers of the Medina are substituted. The chert, which, sometimes, is so plentiful as to form gravel beds in the streams, is often used in building or repairing parts of the roads near the layers, and makes a nice durable road bed. It is the cheapest material for the purpose, being already broken to the proper size for spreading over the grades. The gravel and the small rounded boulders which are stratified in the upper bottoms on the river, occur sometimes in large quantities, within easy reach, and furnish a convenient supply for road construction.

ARCHÆOLOGY.

Though the counties situated along the Ohio river are often rich in evidences of former occupation by prehistoric people,

I could learn of no graves, mounds or other structures, erected or made by them. If such have ever existed, they were not of a permanent kind, and have long since been destroyed. Yet, over the cultivated fields, on highlands and bottoms, there are sometimes plowed up from beneath the surface, implements of flint and other stone, which show, that, even if this region has never been the permanent home of ancient inhabitants, it was at least visited by those from other localities, who, here, joined in the chase for game, or in other pursuits, and, either by accident or by fate, left those specimens as memorials of their presence.

FOSSILS.

The rocks of Oldham county contain immense numbers of fossil remains of the animal life of bygone periods. The remains of the plant life of those periods are not so well preserved, but their markings may be traced on many layers.

The upper part of the Hudson is marked by large masses of *Columnaria alveolata*, *Columnaria stellata* and *Tetradium minus*, and with them, or near the same horizon, occur the *Columnopora cribriformis*, *Streptelasma corniculum*, *Orthis insculpta*, *Orthis subquadrata*, *Murchisonia bowdeni*, and other species. In lower beds the following appear in many places, and some of them in generous profusion: *Orthis lynx*, *Orthis dentata*, *Orthis occidentalis*, *Rhynchonella capax*, *Rhynchonella dentata*, *Zygospira modesta*, *Strophomena alternata*, *Strophomena rhomboidalis*, *Cyclonema bilix*, *Ambonychia alternata*, *Leptæna sericea*, *Streptorhynchus planumbonus*, *Pterinea demissa*, *Bellerophon bilobatus*, *Orthoceras proteiforme*, *Asaphus gigas*, *Calymene senaria*, *Protarea vetusta*, *Stellipora antheloidea*, and many species of branching corals. The trilobites are to be recognized only by the poorest fragments, and many of the forms are so incased with mud that they do not make good specimens to preserve. Some of the rarer forms occur, and the great *Stromatopora* may sometimes be found in its usual horizon. Mud cracks, plant impressions and wave marks, have left their impress upon some of the beds.

The Medina, in Kentucky, does not yield any fossils of its own, but very often casts of some of the Hudson forms, like

the large orthis, may be gathered where the rocks break up into fragments. These are in the very poorest condition, and were swept into beds, when the grains of sand, and the clay composing them, were moved by the old shallow currents. The position, and the silicious character of the material, determine this group, the fossils going for nothing in its determination.

In the Clinton, the lower layer of limestone contains a number of species, some of which are, perhaps, new. A fine-celled variety of *Halysites catenulata* is quite common. Several species of favorite corals, a Stromatopora, and two or more species of cyathophylloid corals, were met with. One of the latter has been described by Mr. W. I. Davis as *Cyathaxonia gainesi*. This horizon seems to be confined, south of the Ohio river, to Oldham and Jefferson counties. The great layer at the top of this group is composed mainly of crinoidal remains, all in so poor a state of preservation as to defy identification.

In the Niagara there are many forms. These, largely associated with the chert deposits, are themselves in a silicified condition. A great number of poor specimens may be gathered from the deposits of chert to be found in many places. Close to the outcrops, where the rocks are breaking down, better ones may be secured. In the magnesian layers, casts of *Calymene niagarensis*, *Atrypa reticularis* and *Pentamerus oblongus* are here and there imbedded in wonderful profusion. From the chert silicified casts of the latter are sometimes gathered in great perfection. *Strombodes pentagonus* is exceedingly common; *Heliolites interstinctus*, *Lyellia parvituba*, *Favosites favosus*, *Thecia major* and *Halysites catenulata*, and many other species, occur also. The poor preservation of these fossils, in this county, is due, to some extent, to the long time of their exposure to all the atmospheric influences. Those broken fresh from the rocks, or unearthed from the beds of clay, are better preserved.

The Corniferous beds are usually rich in the remains of former life, and the rocks of the period in Oldham prove no exception to the rule. Many forms are found, and great numbers of the specimens are well preserved. Some are inclosed in the rocks, some in the numerous blocks of chert, but many are

lying on the surface of the ground, or buried in the rich red clay, left by the destruction of the rocks. A few of the more common and typical species are here mentioned: *Phacops bufo, Astylospongia præmorsa, Hadrophyllum orbignyi, Zaphrentis gigas, Zaphrentis prolifica, Zaphrentis raffinesquei, Cystiphyllum americanum, Heliophyllum halli, Aulacophyllum sulcatum, Cyathophyllum juvenis, Amplexus yandelli, Alveolites squamosus, Favosites turbinatus, Favosites hemisphericus, Favosites limitaris, Favosites placenta, Favosites emmonsi, Dendropora neglecta, Spirifera divaricata, Spirifera oweni, Spirifera euruteines, Spirifera gregaria, Spirifera varicosa, Orthis livia, Atrypa reticularis.* A work in preparation by Mr. W. I. Davis, contains representations of a great many of the fossils from the Niagara and the Corniferous, quite a number of which have not, heretofore, been known.

BUILDING STONES.

Oldham county is well supplied with building stones, and these are readily available in nearly every portion. There are some layers in the Hudson which can be used for construction purposes, but only few of them are desirable. One layer, of fourteen to twenty inches in thickness, which outcrops in a few places in the valleys of Floyd's Fork and Eighteen-mile creek, is an exceedingly well-wearing stone. It has been much used for the foundations of houses, and for steps, troughs, and large gate-posts, and is very well suited for these purposes. Being a single layer only, and usually covered, to some depth, with earth or other layers, the quantity of stripping required prevents its more general use.

The layers of the Medina are nearly always the most treacherous of stones, in Ohio, Indiana and Kentucky. With all the appearance of the best material, they prove the poorest when placed in structures above the surface, because subject to the disintegrating influences of the air. But several layers, taken from the quarries near Lagrange, have proven, upon trial, to be a fair material, lasting well in foundations, or when used for flags, curbing or other purposes. Very poor layers are found associated with these good courses, and such have, too often, been substituted for the better ones.

The Clinton rocks, being unevenly bedded in the greater number of layers, do not furnish any very desirable material, though some few of the thin layers would do, and have been used, to some little extent, for flagging.

The Niagara formation contains the greatest quantity of good stone, of any of the groups. It holds some very fine material for architectural purposes. North and west of Lagrange, the Niagara is near the top of the uplands, and, in ascending or descending the slopes, the outcrops of the formation may be seen. The best building stones, resisting decomposition, are found exposed in benches, at many places. The beds are even, and the courses of desirable thickness. Ranging from six to twenty inches in the strata, they vary from greyish to blue, inside, but on the exterior are brown. There is but little parting between the beds, and in many places little or no stripping is required. These stones work well under the hammer and chisel, and are quarried without difficulty. If transportation facilities were convenient, many fine excavations could be made in the beds.

The natural wear of this stone shows its lasting qualities, and it has stood well the test of time, wherever it has been used. No stone that does not last well in its original beds, can be trusted to give much satisfaction when exposed in structures. It should retain well its broken angles and finer lines of bedding. A stone which chips away or dissolves into sand beds or clays, will not pay to work into piers, fences, foundations, houses, etc.

Among the different members of the Corniferous limestones, an excellent building stone is often found, but here the best layers contain more or less hornstone, which, while hastening their destruction, also makes them most difficult to work. They are, moreover, here overlaid with so much clay and soil, that even good exposures fail to show their better character, or to recommend them to the quarry-master. I could see no evidence of any opening made into these rocks, in the county, the other formations furnishing the material used for local purposes.

OTHER FEATURES.

Some of the layers of the Hudson make a fair article of quick-lime, and have, at times, been burned for that purpose.

In the Niagara there are others which would make an excellent quality of the same article. Experience has shown that some of these beds make the very best of lime. The magnesia in them makes them more difficult to burn, but they yield a better, stronger cement. The best lime used in Ohio is said to be made from the magnesian layers of the Niagara. The cement rock is, in a few places, present in sufficient force to furnish supplies, but the great advantages for obtaining fuel, transportation, etc., offered by the immediate surroundings of Louisville, will always secure to that city the industries of lime and cement-making. In some places in the bottoms, fair qualities of building sand are found; but the demand has, so far, been very slight. Clays for brick making are pretty generally distributed over the formations in the county, and some of them are very good.

APPENDIX.

STATISTICS OF OLDHAM COUNTY, COMPILED FROM THE UNITED STATES CENSUS REPORT OF 1880, THE STATE AUDITOR'S REPORT OF 1885, AND OTHER SOURCES.

1880.	Total population . .	7,667
1870.	Total population . .	9,027
1860.	Total population . . .	7,283
1880.	White population . .	5,456
1870.	White population . .	6,217
1860.	White population . .	4,815
1880.	Colored population .	2,211
1870.	Colored population .	2,810
1860.	Colored population .	2,468
1880.	Native population . .	7,456
1870.	Native population . .	6,805
1880.	Foreign population .	211
1880.	Lagrange population .	690
1880.	Westport population .	219
1880.	Number of farms . .	839
1880.	Assessed value of real estate	$1,773,273
1880.	Assessed value of personal property	$597,583
1880.	Assessed value, total .	$2,370,856
1885.	Miles of railroad . .	15.27
1885.	Value of, in the county	$390,700
1885.	Miles of turnpikes . .	47½
1885.	Average cost per mile,	$3,350
1885.	Total cost of turnpikes,	$159,125
1885.	Number of horses . .	2,394
1885.	Number of mules . .	551
1885.	Number of cattle . .	5,612
1885.	Number of sheep . .	15,323
1885.	Number of hogs . . .	4,735
1885.	Value of horses . . .	$112,500
1885.	Value of mules . . .	$24,915
1885.	Value of cattle . . .	$90,800
1885.	Value of sheep . . .	$30,950
1885.	Value of hogs	$11,260
1885.	Total acres of land . .	116,000
1885.	Average value per acre	$13.40
1885.	Bushels of corn raised .	207,450
1885.	Bushels of wheat raised	61,450
1885.	Tons of hay raised . .	4,625
1885.	Pounds of tobacco raised	121,500
1885.	Pupil children . . .	2,281
1885.	Total assessed val'tion,	$2,448,100


CARROLL CO.
TRIMBLE CO.
OLDHAM
HENRY
SHELBY
JEFFERSON CO.
SPENCER CO.
GEOLOGICAL SURVEY OF KENTUCKY
MAP OF
HENRY, SHELBY AND OLDHAM COUNTIES