
GEOLOGICAL SURVEY

OF KENTUCKY,

JOHN R. PROCTER, DIRECTOR.

REPORT

GEOLOGY OF MASON COUNTY,

BY W. M. LINNEY.

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

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INTRODUCTORY LETTER.

HON. JOHN R. PROCTER,

Director of the Kentucky Geological Survey:

DEAR SIR: This note is intended to accompany my report on Mason county, and should be published with it. I desire to express my thanks to W. D. Hixon, Dr. Pickett, Col. Bierbower, and other gentlemen of Mason county, for their unvarying kindness to me while with them. I am,

Yours respectfully,

W. M. LINNEY

HARRODSBURG, KY., December, 1885.

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GEOLOGY OF MASON COUNTY.

HISTORY, TOPOGRAPHY, ETC.

Mason, the eighth in the order of formation of the Kentucky counties, was established in 1788, and received its name from George Mason, one of its earliest prominent men. When first formed, it included all that part of the State lying east of the Licking river. Out of this territory, constituting nearly one-fourth of the area of Kentucky, there have since been formed twenty counties. It now contains 148,383 acres of land; and is bounded on the north by the Ohio river, east by Lewis and Fleming, south by Fleming and Robertson, and west by Robertson and Bracken counties.

The general surface of the county is that of an undulating plain, rising from four to five hundred feet above the Ohio river, but, in a large part, deeply carved by many small streams, which carry off the surface water without leaving any marsh or wet places. Only on the river are there any truly level lands; but a limited portion of the uplands, in small areas, is slightly undulating. The greater part is rough or broken, with numerous steep slopes down to the bottoms of the hollows.

The frontage on the Ohio river is about seventeen miles in length, and for more than half this distance, bottoms of varying width have been formed. These are level, or nearly so, and contain very desirable lands. Back from these bottoms, and from the river generally speaking, the bluffs slope up to the level of the country. These bluffs are usually of that gently rounded form which is so pleasing to the eye, being carved and moulded into graceful shapes by a multitude of lines which facilitate the downward flow of the water. The outlines of the river and of the hills on either side, are, indeed, beautiful throughout this county, and the beholder readily understands how the early French explorers came to designate

this river as "the beautiful river." The channel is deep and unobstructed, admitting of continuous navigation by steamboats. A number of landings along the margin afford the inhabitants of this county great facilities for travel and shipping.

Cabin creek, rising in Lewis county, enters Mason, and with its tributaries drains the north-eastern portion of it into the Ohio. Bull, Kennedy, Limestone, Beasley, Lawrence and Lee's creeks all flow into the same stream. The North Fork of the Licking river enters Mason near the south-east corner, and after flowing through it in a general direction slightly north of west, enters Bracken county. In Mason county it is reinforced by a number of creeks, among which are Mill, Wells', Lee's and Shannon. Bracken creek heads in the western part of Mason county, but runs through part of Bracken county before it joins the North Fork. A few small brooks have their source in Mason, but enter Johnson's creek in Fleming county, whence their waters find an outlet into the main fork of the Licking river. On many of these creeks mills were erected by the earlier settlers of the county, but more recently the water-power of those that still remain has been supplemented by steam power, which is used during the greater part of the year.

The Maysville Branch of the Kentucky Central Railroad extends from the Ohio river at Maysville, southward through the county, near its center, and does a large amount of business all along its line.

Few counties can equal this one in the number and character of her turnpike roads. This system has about two hundred and thirty-five miles of road-way completed, reaching nearly every part of the county, and costing a large sum of money, the county paying subscriptions amounting to about \$180,000, collected by taxation.

The condition of the public schools is superior to that in many of the civil districts of the State, with the promise of still greater improvement in the future. The county is not burdened with heavy indebtedness, and in a short time hopes to be entirely free from debt.

Maysville, situated on the Ohio river, at the mouth of Limestone creek, is the county seat, and, at the same time, the prin-

cipal town. It is a pleasant, flourishing city, surrounded by picturesque scenery. Washington, an old and once flourishing place, is three miles and a half south-west of Maysville, and was for many years the county seat. Dover, Lewisburg, Mayslick, Minerva, Germantown, Sardis, Helena, Mt. Gilead and Murphysville, are small villages distributed over the county, while Woodville and Chester are suburbs of Maysville. Some manufacturing is done in Maysville, but the county is essentially given to farming and stock-growing.

GENERAL GEOLOGY.

The general geological section of Mason county is included in much narrower limits than are many others in the State; but it is not wanting in interest. The following section gives the thickness and relation of the groups which are exhibited in it:

		Feet.	Feet.
Quaternary	Recent.	. . . . .	100
Upper Silurian	{ Niagara. Clinton. Medina.	15 35 20	70
Lower Silurian	{ Upper Hudson. Middle Hudson. Lower Hudson.	340 175 165	680
Total			850

This thickness is not to be seen at any single point, but is obtained by adding the thickness of the river bottoms to the lower series, above the river, on the Bracken line, and thence across the county to the Lewis line, where the highest rocks are to be found.

LOWER HUDSON BEDS.—These, the lowest division of rocks appearing in Mason county, are usually, in the State, about two hundred feet in thickness, wherever they can be seen entire. At the mouth of Lee's creek, on the Ohio, there is exposed

about one hundred and sixty-five feet of them, the remainder being below the level of the river. In going up that stream, they dip down and are all lost to view before the Lewis county line is reached. There is about one hundred feet of them exposed on the North Fork of Licking, at the Bracken county line, disappearing with the same dip a short distance below Lewisburg. Many of the branches in the north-western part of the county have cut their beds to various depths into this stratum, and numerous exposures of it can be seen; not in any one single section, but taken here and there, different portions are presented, which, when added together, render possible a study of them all.

This series has been described in the reports of several counties of the State, so that little more need be written on its characteristics. Thin-bedded limestones, blue or grey in color, usually hard and resisting, with more or less of earthy shales between them, form the majority of the layers; the shales washing out easily, and allowing the solid blocks to fall down and become exposed on the surface. These are some of their general features. Near the top the heavier layers present themselves, and these are rough-bedded and incline to cross-stratification. The several layers which are characterized by great wave-marks are as persistent features here as at other points in the blue limestone region. They are found in numerous localities. Forty feet of this section may be seen at the point below Maysville; of these about thirty feet are shales and the remaining ten feet are thin limestone plates, intercalated in the shales. The hard layers are usually filled with the fossils common in or peculiar to this horizon, while the same fossils are rarely found in the soft shales; and this is in keeping with the character of these beds throughout the larger part of their exposure in the State.

In the early history of this county a number of stone houses were built from some of the strata of this division. The stone has generally stood the test of time very well, yet it is not very desirable for costly structures, as it is hard to work and has no great beauty. A few thin layers have properties which would fit them for hydraulic purposes, but they are too few and thin ever to be profitably used. The soils derived from the destruc-

tion of the Lower Hudson are not so characteristic here as they are in some other counties, from the fact that they are mixed on the slopes with those coming from the next series above them. They are naturally good, but, lying on steep slopes and being usually friable loams, they are quite apt to wash very badly.

Taking these beds altogether, they are very much alike wherever exposed, and, perhaps, more uniform in thickness, character and general association, than any of the divisions of the paleozoic rocks of Kentucky.

MIDDLE HUDSON BEDS.—This division, as has been stated a number of times, is the equivalent of the series named by Dr. D. D. Owen the siliceous mudstone. As there are in the State other rocks of this character, and the name did not express any relation to age or group, the above name was substituted. It indicates their place as a part of the Hudson, a national term in geology, as well as the minor division of the period.

On the Bracken county line their place is from one hundred and sixty-five to three hundred and forty feet above the Ohio. As you follow them up the river, they slope down with the Lower Hudson, until, at the Lewis county line, part of them have dipped beneath the level of the water. They make up the larger part of the slopes exposed along the river front, and the rounded hills are the result of the character of the strata, both mechanically and chemically speaking. These rocks are exhibited in North Fork, a short distance above Lewisburg, and rising towards the west, they are on the surface over a large area, till the Bracken and Robertson county lines are reached. In many of the creek beds, and the slopes to them, the general character of this formation can be seen. It is peculiar in the slopes which it assumes, and in the mass of material of which it is composed.

The most remarkable feature in these rocks, is the presence of two layers of stone, one at the bottom and the other near the top. These are peculiarly rough and rugged, where seen to advantage, and have what is usually termed a concretionary structure. They are composed largely of siliceous sand in very fine subdivision, some earthy matter and a proportion of lime. When fresh and broken the interior is blue, but on exposure

the lime leaches out, the iron contained in them oxidizes, and they become brown. They sometimes split into bowl-shaped fragments, but are often found in the shape of large balls, irregularly outlined. These must have had their origin in very tempestuous currents of water, where the materials on the sea-floor were swept in eddies and deposited in whirling currents.

Hard, dense limestones make up some portions. Some of these are even-bedded and smooth surface stones; and from them, and from some of the layers of the succeeding series, a number of houses were built in olden times, about Mayslick, Washington and in other neighborhoods.

The greater part of these beds is, however, composed of blue or olive-colored shales, which contain much siliceous matter. These become brown on exposure, as do the sandstone layers, which make up part of the whole. In one part of the section seen in the county, there was only one foot of thin rocks in an exposure of twenty feet. In the fifty feet above there was forty feet of shale to ten feet of hard layers. These shales are seldom brought to view. The limestones have often been dissolved away from the surface, being more easily acted on by carbonated waters than are the shales and sandstones. Streams cut rapidly through them, and thus they are marked by deep, narrow gorges, quite difficult to cross with roads.

Where these lands are covered with native forests, or have been recently cleared, the soil is, as a general rule, rich, deep and friable, and with proper care, could be preserved in this condition; but over a large part of these areas they have been much injured, and in many places almost ruined, by being allowed to wash away into deep gullies, or even down to the bare rocks. Thus thousands of acres of valuable land are no longer cultivated, but given over to the growth of any self-propagating plants. This is more particularly true of part of the valley of the North Fork, on the west side of the county, where these beds are, in a large measure, on the surface.

The concretionary layers are less thick-bedded than those in Madison county; nor are the sandstones as heavy and typical as there. It would seem, from the greater mass of siliceous matter, and its coarser character in Madison and Garrard, that

the materials, or at least the sandy part of them, had been spread from the south or south-east, as it diminishes northward, both on the east and the west side of the outcrops. On the other hand, the shales increase toward the north; yet, being of lighter material, and more easily moved by the force of the water, they may have drifted from the same direction, viz: the south.

The fossils are generally imbedded in the hard limestones, and as these are partially crystalized, it is very difficult to obtain good specimens. A few casts of shells, corals and trilobites may be seen in some of the sandstone layers, but they are very poor. Occasionally shells are found in the shales, but in a more or less decomposed condition. Plant impressions and curious mud-markings are sometimes to be seen on the surface of a few layers, while the layer of large wave-marks is always conspicuous. In a few places, which, in times past, have been inclined to be swampy, small quantities of bog-iron-ore, mixed with a little manganese, were deposited, which now appear as shot-iron-ore. This is worthless, but it is mentioned as showing the persistency of this feature in these beds where the conditions are alike.

These soils, where well cared for, are very productive, yielding fine crops of corn and fruit, also a valuable quality of fine silky tobacco. When deep, they are very retentive of moisture, and in the dryest of seasons give good returns.

The shales contain more than ordinary proportions of potash, and, with judicious culture, this would hold out through many successive crops of tobacco; but quite a number of good farms have been ruined by wasteful cultivation and reckless treatment. Where the soil has not been washed away or torn into rugged gullies, these lands may be redeemed, but it requires care, time and judicious treatment, such as setting in grass, and in many cases, applying fertilizers.

In moist places, and on the north sides of hills, beech trees are the prevailing growth; magnificent yellow poplars, large walnuts and many linnns, being mixed with them. Thick groves of sugar maples may be found where the lime rocks are near the surface, while, where the clays are heavy and stiff, white oaks form a large part of the forest. Groves of post oaks are

rare, and generally interspersed with black hickory, black oak, ash, buckeye and dogwood. Young trees come up wherever they have a chance, and grow rapidly. Sumac, red and black haws, sassafras, blackberries, smilax and wild grapes soon spread over these soils, when turned out, and black locust seem to claim them as their favorite soils.

UPPER HUDSON BEDS.—The larger part of the surface of Mason county, is based on the upper portion of the Hudson Group. Here are more than three hundred feet of blue limestones and shales, in alternating series, throughout the whole section exhibited on the Ohio, at the upper part of the county; but towards the western side gradually losing the upper part, until, on the hills of the Ohio, at the head of Lee's creek, only the basal portion is left. The shales proper are thin, except at the top, but the larger part of the limestones are what is usually termed shelly, and when exposed crumble down into fragments or soils. A few hard and resisting layers are in courses, which allows them to be used for a number of common building purposes. Now and then, layers are grey or of some darker shade.

In a number of the creek beds, on some of the hill-sides, and in the turnpike and railroad excavations, many good exposures of small sections of these rocks are to be found. The massive and rugged bed of *stromatopora* corals which is so often characteristic of this group, even in Bath and Fleming counties, seems to be notably absent in Mason. The great coral bed of *columnaria* and *tetradium*, which so strongly marks the upper portion in many of the counties of the State, has almost disappeared here. A few specimens may be seen, but they are of rare occurrence, and small in size.

The rocks here do not show that remarkable fracturing to which they have been subjected in the counties more to the south and west, nor are seams and masses of calcite so prevalent in them. These limestones contain more alumina than the same series in the counties on the opposite side of the blue limestone region, so that in their destruction they give rise to clay soils, but the large amount of lime and phosphates imparted leaves them as calcareous loams, light and friable.

The layers present at the base in Garrard and Madison counties, and so strongly characterized by *Ptilodictya Hilli*, and an association of ancient life, are entirely absent here, while the beds of *orthis lynx* and *occidentalis* make up nearly the whole section.

At the top are some thirty feet of sandy clay shales, which wear down into deep clay beds, but, owing to the sand present in them, are easily eroded. These, where uncovered by vegetation, gully out rapidly and leave unsightly tracts.

There are no finer soils than those which result from the wearing down of the larger part of these beds in Mason county. Some of those about Mayslick, Washington, Germantown and other sections, are admirable; just undulating enough to give gentle drainage, but on every side they give way to deeper lines, where the slopes are steep and the drainage is more rapid.

The rocks are nearly always a compacted mass of fossils, and in the process of decomposition these are thrown out in great numbers on the surface or in the soil. They are usually incrust- ed with clay to such an extent that they are difficult to clean. The best soils are marked by blue ash, hackberry, chinquapin oak, wild cherry, sugar maple and coffee tree. Those with heavier clays and less calcareous and organic matter, show a growth of white oak, red oak, burr oak, post oak, elm, mul- berry, white and black walnut, with occasional specimens of other species growing in various aggregations. In the upper part of this series, near Orangeburg and other points, some of the layers have more or less iron sulphide in them.

UPPER SILURIAN.

In the eastern part of Mason county, along the lines of Lewis and Fleming, the remnants of the Upper Silurian beds are capping the highest points. Undoubtedly, in the ages long past, these strata were continuous over the whole county, while upper and still higher rocks were also in place. These have been removed, as the creeks, rills and rivers are now carrying away to the sea the soils, clays and rocks from every slope, farm and field.

MEDINA.—At the base of these rocks are some twenty feet of sandy shales and sandstones, of a blue color on the inside, but a dirty yellow on the outside, which break down and crumble away into a sandy soil, easily rendered barren by washing. Very little of this is seen, however, considering the area of the county. The stones are of no value, and the soils from them are soon exhausted under cultivation, unless great care is taken of them.

CLINTON.—Overlying the Medina are some thirty-five feet of rocks which belong to the Clinton group, as it was named in New York, and adopted in all the States. These are composed of some twelve feet of blue shales at the base, eleven feet of limestone, of which the larger part holds large quantities of grey flinty chert, and, above, some thirteen feet of shales alternating with layers of limestone. These limestones are magnesian and turn brown or yellow, or reddish-brown, on exposure, from the oxidation of the iron which they contain. They are all poorly fitted for building purposes, but have some value in road-making. When the limestones dissolve away, large quantities of the chert are thrown on the surface, or left imbedded in the soil, and these may be found far removed from any beds now remaining. They illustrate in part the former extension of the Clinton. The layers in the upper part are somewhat sandy, and this sand, under favorable conditions, has modified some of the clay soils derived from the clay shales at the base.

The Clinton forms a very fair soil, but is improved by fertilizing and the growing of grass, its position and character here fitting it for fruit-growing especially.

NIAGARA.—This group completes the section of the county, and is here comprised in about fifteen or more feet of blue shales, which form a white clay soil on some of the ridge tops near the Lewis county line. In one or two places the area is broad and nearly level, offering very pretty locations for farms. With the aid of bone-dust, and by the occasional plowing under of green crops, these lands could be made very desirable for wheat, grass and fruit, while root crops, also, could be grown very profitably. These shales have a thickness of one hundred feet towards the north, east and south, and

there is no reason for believing that their thickness was any less over the whole surface of Mason county, in times past.

Near Rectorville a little petroleum oozes out from the Upper Silurian rocks, but the quantity is very small, and so is the prospect of its ever being of any value. This, perhaps, had its origin in the black slates which once covered the county here, and in their destruction the oil found its way down into some of the small cavities in the strata.

QUATERNARY.

On the Ohio, bottom lands of various heights above the water, and of various widths, extend along the stream. The bottoms are not continuous, for there are places where the current sweeps against the foot of the hills, leaving the rocks bare. These flat lands have been formed by the more recent action of the river. The valley has been cut down and widened, first on one side and then on the other. Where the current has been swift and unhindered, no deposits were made from the waste material, but where the movement of the waters was slow, and retarded by impediments, the various matters found lodgment. Large fragments of rocks, gravel, sand, mud and shells, fragments of coal, trees and wood, masses of leaves and other vegetable matter, with skeletons of birds, fish and mammals, and many other things have been deposited, and thus these bottoms were formed. Running water assorts the various materials which are thrown into it, according to their size and density, substances of the same size and weight being deposited together. In this wise these, like other alluvial deposits, show a certain arrangement. Beds of gravel are on a level, sometimes for miles overlain by beds of clay; and these again with wood and leaves, or sand, or even shells. Such alternations of substances make up these bottoms.

By a change of the current a bottom is sometimes entirely cut away, while part of the materials form themselves into another bottom lower down the river. These operations can be seen going on all the time.

There are, generally, two bottoms on the Ohio, an upper and a lower one, though remains of what appear to have been

others are frequently found. The upper bottom was formed long ago, when the level of the river was higher than at present. The valley had not been excavated to its present depth, and this was the flood plain of the period. The lower bottom has been formed, and is still being formed, where the greater floods spread over it, by the continual deposition of new matter. When the upper bottom had reached such a height that the floods could no longer cover it, the other was formed at a lower level. Some of the lower bottoms have formed above the present rises of the river, and no longer receive additions of matter, but there is a disposition of the river now to form other bottoms, wherever the conditions are favorable. This can be seen at the point just below Maysville, where, on the Kentucky side, the current is cutting away the shore, while, on the other side, a bar is left, which, if the present conditions remain, will, in time, become a low bottom.

There are no remains of drift in Mason county above the higher bottoms, nor is there any evidence of any change in the present from the former elevations of the county, or of extraordinary movements having taken place since the valley of the Ohio commenced to take shape. Among the rocks and pebbles of these bottoms, specimens of northern origin, such as granite, gneiss, greenstone, diorite and other forms, are frequently found; but these have been brought from the drift region into the Ohio by its northern tributaries. The materials come from all the formations drained by the river: the Lower and Upper Silurian, the Devonian, the Subcarboniferous and the Coal Measures, as well as the drift, have all aided in these accumulations; and the same sources furnish the materials which are drifting along at the present day. Layers of logs of wood, and of other vegetable matters, are occasionally imbedded in these bottoms. The islands and bars of our rivers are sometimes covered with immense accumulations of drifted timber. When these become covered with subsequent deposits, the conditions are filled which produced these vegetable beds.

The upper portions of the higher bottoms are about one hundred feet above low water, and have all been subjected to long erosive action, so that they are not level, like the lower

ones, which are between sixty and seventy feet higher than the river. The soil of the lower level is usually better than that of the higher, for it has not been submitted to the same amount of leaching and erosion. It is a fine loamy soil, much prized for the cultivation of corn and grass. The soils of the upper bottoms are especially well suited for raising melons and other vines, and those of Mason have long been known to be valuable for this purpose, though they are often planted in tobacco and other crops.

Some of the beds of clay found here are very valuable for brick-making, and have been largely drawn upon for this industry.

Beds of sand suitable for moulders' use are also found and have been utilized. The lower bottoms were originally covered with thick-growing beech trees, and the upper, while containing much of this species, bore also very fine specimens of yellow poplar, white oak, walnut and other trees. With the exception of a few small areas, all the surfaces have been cleared of the forest, and the exceptions are chiefly the higher and more rolling places.

The colored map exhibits the surface extent of the various groups herein described.

SOILS.

At the time when the first settlements were made in what is now Mason county, the surface of the country was everywhere covered with a dense forest growth. The soil, enriched with the leaf-mold of many centuries, was unsurpassed in fertility. Rocks could rarely be found, save only in the stream beds and on the steeper bluffs by the creeks, and then they were covered with mosses and lichens. Only a few rods of earth were denuded, around the saline springs, where the wild buffalo and other animals came to drink. Various canes and grasses, flowering plants and ferns, robed the earth in green, and held back the waters which fell as rain. Had these soils been cleared in a judicious manner, as experience and science would suggest, they might have been nearly as fertile to-day as they were one hundred years ago.

Instead of a wise system of clearing and preserving fields

and pastures, keeping and controlling forest, saving the sources and retaining the supply of water, and beautifying the country, destruction and ruin have followed in the path of the ax and the plow, until, to-day, thousands of acres of land are almost barren wastes, tens of thousands are gradually becoming unprofitable, and only in rare instances has thoughtful care been given to the preservation of fields and farms. Rarely has an almost ruined farm fallen into intelligent hands, and received the treatment which nature teaches to be the true means of restoration.

One sees, here and there, slopes from which all of the soil has been washed away, leaving only rugged rocks exposed where valuable species of trees should be growing; fields which should smile with growing grain covered all over with stones, so thickly that the plow can not run; clay soils from which the organic matters, the potash and the phosphates, have been largely removed, that should be yielding generous harvests; the ruins of an old mill by the side of a dry gulch, where water should flow all through the year; the fallen ruins of a spring house, in a nook below the residence, and the owner hauling water for a mile, where a fountain should gush forth and wend its way to join the singing creek!

Vast quantities of soil have been washed away for want of protection, and others, by leaching, robbed of their rich elements, which should have been preserved. Crops have been fed in places where their refuse could be most easily washed into the creeks and carried off. Stables have been built over, or by the side of branches, where the rich manures were liable to be carried away by the rush of waters. Harvests have been hauled from the fields and fed by the roadside, or sold to a distant buyer. Fields have been robbed of every source of nourishment in every imaginable way, and nothing given in return. In the hurry and eagerness for present gain, no thought or care has been given to the future. With no lasting attachment for home or birth-place, no tender love for field or pasture, the fences tumble down, the fields grow thin and poor, the barn rots away and the dwelling falls into decay, while a little money transfers them all to another owner.

The thoughtless, ceaseless destruction of soils and forests is

a crime against humanity; the careless, continuous waste of crops and fertilizers is a grievous sin against intelligence, while the absence of love and veneration for the homestead and its surroundings, and the ready bartering away of its precious presence and memories, constitute a foul blot upon the character of our State. Until the people become attached to their home-places, and learn to love and care for their fields, orchards and meadows, which, with generous care, would ever give them grateful returns, there can be no great improvement in our general agriculture.

It is not enough that we be taught that continuous cultivation and removal of all the crops from a farm will impoverish it, that soils washed away, and plant-food wasted, do not return of their own accord, and that, like organized beings, soils need certain kinds of matter, and that in certain proportions, as plant food, to insure an ample return.

Within the last few years cases have occurred, where the avenues leading to residences, the grass lots and gardens around dwellings, the little clumps of thickets, the meadows and pastures, and the remainder of the strip of woodland, have all been cleared, broken by the plow, and given over to the cultivation of tobacco, until they would produce no more. The same men who thus despoil these lands have gone into other counties, and, with the same hands, are robbing them also of their fertility, and paving a yet wider pathway of destruction. Every county given over to the character of cultivation which these tobacco land-hunters practice, are but sowing a whirlwind of destruction. Some lands may be judiciously cultivated in this crop, and, by proper rotation and treatment, their fertility may be but little impaired; but there is little hope for those given over to the enormous greed and careless indifference of the regular peripatetic tobacco-grower.

There are some exceptions to these great curses, which, by the way, are not confined to Mason county; for we find well-kept, beautiful farms, with all the delights of home, and farmers and stock-growers owning well-ordered places, who take a just pride in the care and improvement of their surroundings. Here, a proper rotation of crops growing a wealth of grass, the judicious use of fertilizers, the turning under of green veg-

etable matter, a just distribution of stock, and intelligent tillage, will produce handsome returns from the highest-priced farms in the State.

Some twenty-five years ago Mr. Anthony Kilgore, a public-spirited citizen, introduced into Mason county the meadow fescue, *Festuca elatior*, and it has been largely grown under the name of English blue-grass. This grass is much esteemed for its several good qualities. It develops a great mass of roots which extend deep into the ground, forms a pasture sooner than the Kentucky blue-grass, and, when plowed under, protects the ground from washing better than clover, while its renovating properties are, by observing farmers, considered superior to even those of red clover. It ripens about the 10th to 15th of June, and produces much seed, so that growing it for seed is quite a profitable business. It ought to be more extensively cultivated in the State than it is at present, and would, perhaps, grow well where blue-grass does not succeed.

In this connection it may be remembered that, in my report on Clark county, mention was made of the introduction of blue-grass into that county, and of the belief that it was indigenous on Grassy Lick, in Montgomery county, at the time Kentucky was first settled. The following copies of statements on file among the court records of Fayette county have a bearing upon this question.

“John Darnell entered 864 acres of land, upon a Treasury warrant, upon Pasture Lick (now Grassy Lick), about half a mile below the lick, to include a piece of low ground remarkable for English grass, and extending north-west on both sides, for quantity, May 17th, 1780.”

“Ebenezer Corn states that, in 1776 ‘I was traveling from the Blue Lick Springs to where I now live, and on my way passed up this (Pasture) creek to a lick, where I saw a quantity of blue-grass on said lick.’”

“A company in 1779, composed of Moses Thomas, Enoch Smith, and others, Thomas says: ‘We turned out our horses for feed on the blue-grass or English grass, which was the first we had seen in the country. Enoch Smith was our leader, and called the lick Pasture Lick, because we turned our horses out

on the blue-grass.' Enoch Smith said: 'It was so remarkable for the English or blue-grass, that the company named it Pasture Lick.' "

A deposition made in 1802, by William Yates, states: "In 1775, was acquainted with Grassy Lick. Its bottom was remarkably set with blue-grass, more than any bottom on the creek."

There is testimony which goes to show that in 1780 blue-grass was native, and growing at the three forks of Johnson's creek, in Mason county. At this time the country was not settled. We read, that, at the time of the first entrance of white men into Kentucky, blue-grass was indigenous to the region, and was at least growing in several places. The blue-grass, fescue grass and red clover, are wonderful renovators of soils, where they will grow; many worn lands, if well set in them, would, in a few years, be vastly improved, and nearly all lands, with care and the help of fertilizers, could be made to grow them.

Analyses of a great number of the soils of the State have been made by Dr. Robert Peter, the Chemist to the Survey, and from them I have selected the following. Three are given below from the soils of the Upper Hudson. No. 1, virgin or uncultivated soil; No. 2, soil from a field exhausted from tobacco culture, and No. 3, a subsoil from the same land as No. 2. The first contains elements, and in proportions, which make it quite rich. The second has lost largely of the elements essential to some growths, while the last exhibits the presence of the substances necessary for a restoration in part:

	No. 1.	No. 2.	No. 3.
Organic and volatile matters	8.462	6.445	5.931
Alumina	4.745	3.780	4.395
Oxide of iron	6.240	4.465	4.090
Carbonate of lime . . . . .	.836	.476	.497
Magnesia . . . . .	.798	.807	.618
Brown oxide of manganese . . . . .	.146	.221	.196
Phosphoric acid . . . . .	.231	.212	.245
Sulphuric acid . . . . .	.084	.042	.059
Potash . . . . .	.558	.418	.475
Soda . . . . .	.160	.023	.079
Sand and insoluble silicates	78.100	83.380	83.130
Loss . . . . .			.285
Total	100.360	100.169	100.000
Moisture, lost at 400° F. (per cent.)	4.175	3.265	3.050

If Nos. 1 and 2 were originally of the same composition, a comparison would show that No. 2 had lost nearly twenty-five per cent. of organic and volatile matters, more than thirty per cent. of oxide of iron, nearly one-half of the carbonate of lime, and gained twenty-five per cent. of potash, and eighty-five per cent. of soda. A few crops of grain grown on this land would have removed much of the phosphoric acid and other portions of the remaining elements, and left it poor indeed. The proportion of loss is very large, but it is just such losses that our finest lands are being subjected to every year. Many lands, with this drain upon them, would become practically valueless, but here the subsoil contains the properties for a renewal of fertility. Subsoiling, grassing and the turning under of green crops, would bring it back to nearly its former condition.

The marly or shaly rocks which lie between the limestone layers, over much of the county, are usually quite rich in phosphoric and sulphuric acids, potash and soda, and the decomposition of these, on the surface, produces admirable results in the formation and renovation of the soils. The following is the composition of a sample:

DRIED AT 212° F.

Sand and insoluble silicates	78.180
Alumina and oxides of iron and manganese	8.020
Carbonate of lime	7.380
Magnesia	3.105
Phosphoric acid	1.040
Sulphuric acid . . . . .	.592
Potash . . . . .	.722
Soda . . . . .	.170
Water and loss . . . . .	.791
Total	100.000

The composition of the limestones may be seen from the following table of the analyses of three samples, all taken from the Upper Hudson beds of Mason county. Sample No. 3 must have been taken from one of the layers, which contain considerable amounts of sulphide of iron, as the proportion of sulphuric acid is excessive:

	No. 1	No. 2	No. 3
Carbonate of lime	75.440	87.980	77.360
Carbonate of magnesia	4.783	1.721	2.307
Alumina and oxides of iron and manganese	3.751	2.200	3.910
Phosphoric acid . . . . .	.409	.348	.310
Sulphuric acid . . . . .	.474	.372	2.433
Potash . . . . .	.540	.289	.424
Soda . . . . .	.292	.047	.068
Silica and insoluble silicates	14.440	6.380	13.980
Loss . . . . .		.663	.666
Total	100.129	100.100	101.458
Moisture lost at 212° F. (per cent.)	0.400	0.200	0.300

The best soils of the county have been derived from the destruction of these and kindred limestones and shales. They are as richly endowed with the minerals which enter into the formation of good soils, as any found in any county.

All of these rocks are literally made up of vast multitudes of shells, corals and other forms of life existing at the time of their formation. These have furnished the lime, phosphoric acid and portions of the other constituents of the soils, and, as it has required untold ages to give them their present character, it is, at least, unfortunate that man, in his ignorance, folly and greed, should have the power to impoverish them in a few years.

The alluvial soils of the Ohio Valley have a deserved reputation for excellence. Their location makes them convenient to market, their mechanical character allows them to be readily worked, and their evenness of surface prevents them from washing; yet, even with these conditions, they do not receive the care to which they are entitled. Where they are subject to occasional overflow, their fertility is renewed. The following table exhibits the average composition from analyses of three of these soils. These soils are richer in potash than any others in the State, and contain less sand and insoluble silicates than any, except the Trenton soils derived from more than ordinary pure limestones. Nevertheless, they are light silicious loams. The amount of magnesia is small and the percentage of lime is quite low, notwithstanding the great number of land

and fresh water shells deposited with them. The proportion of alumina is quite large :

Organic and volatile matters	3.472
Alumina and iron and manganese oxides	9.835
Lime carbonate	0.102
Magnesia	0.189
Phosphoric acid P_2O_5	0.118
Potash, extracted by acids	0.400
Sand and insoluble silicates	84.310
Water expelled at 212° F.	2.513
Potash in the insoluble silicates	0.405

MINERAL SPRINGS, ETC.

At Orangeburg there are two springs of white sulphur water. One of these boils up from the bed of the creek, and has had some reputation as a pleasant and healthful mineral water. There is some iron sulphide distributed pretty regularly through several of the limestone beds in this part of the county, and especially can this be observed in the stones which have been quarried at the village. This, evidently, furnishes the sulphur to these waters, while a portion of saline matters, possibly, is derived from the shales. There was a sulphur spring at Mayslick, which is now covered by a fill in the turnpike.

A spring of the same kind may be found on Indian creek, below Mt. Gilead, and from these several springs small quantities of salt have been made in times past. The one at Mayslick was so used as early as 1778. These waters have been represented as being much like the Blue Lick waters, only containing much less salt. They have a very slight saline taste at the present time. A few other springs in the county contain some little iron, salt or sulphur, but they have not even a local notoriety.

Lime of very fair character can be made from many layers in the different groups of rocks in Mason; but there is no industry of this kind being carried on.

Some fair blue and grey limestones, for building purposes, are to be found, and in the earlier history of the county quite a number of stone houses were built; some of these are in use to-day, and show much of the stone used in their construction to be quite durable.

The disturbances of which the rocks of Mason county bear evidence, are few: a row of sink-holes and natural ponds extends from the Fleming line nearly to the Ohio river. This is probably on the line where the rocks are all deflected towards the east in Fleming, and in Brown county, Ohio. Mention of this was made in the report on Fleming county. In the creek near Orangeburg the rocks have a dip to the south-east, for a short distance, but away from this point they usually are almost level.

FOSSILS.

Below is given a list of such fossils as were noticed during the work over the county; very little time was given to any search for specimens. Quite a large number of these are common at their horizons. In a very thin plate among the clay shales of the Lower Hudson, in one of the branches that enters Limestone creek, I found a fragment of *Stenaster*, and, close to the river, a short distance below Maysville, I came across a number of the eyes which have been referred to the trilobite, *Dalmanites carleyi*.

The large brachiopod shell, *orthis lynx*, is common through nearly the whole of the Upper Hudson, while the bull-horn coral, *Streptelasma corniculum*, which is usually restricted to a few feet near the top, has a range here of, perhaps, a hundred feet. Some good specimens of *calymene senaria* have been found, but most of them are poor and fragmentary.

UPPER HUDSON BEDS.

1. Tetradium minus. (Safford.)
2. Columnaria alveolata. (Hall.)
3. Streptelasma corniculum. (Hall.)
4. Palæophyllum divaricans. (Nicholson.)
5. Monticulipora dali. (Edwards and Haime.)
6. Monticulipora delicatula. (Nicholson.)
7. Monticulipora frondosa. (D'Orbigny.)
8. Monticulipora lycoperdon. (Say.)
9. Monticulipora mammillata. (D'Orbigny.)
10. Monticulipora orton. (Nicholson.)

11. *Monticulipora ponderosa* ?
12. *Monticulipora gracilis*. (Nicholson.)
13. *Constellaria antheloidea*. (Hall.)
14. *Alecto inflata*. (Hall.)
15. *Serpulites jamesi*. (Nicholson.)
16. *Orthis lynx*. (Van Buch.)
17. *Orthis occidentalis*. (Hall.)
18. *Orthis insculpta*. (Hall.)
19. *Orthis subquadrata*. (Hall.)
20. *Orthis jamesi*. (Hall.)
21. *Orthis occidentalis*. (Hall.)
22. *Orthis plicatella*. (Hall.)
23. *Rhynchonella capax*. (Conrad.)
24. *Rhynchonella dentata*. (Hall.)
25. *Strophomena alternata*. (Conrad.)
26. *Strophomena nasuta*. (Hall.)
27. *Strophomena rhomboidalis*. (Wahlenberg.)
28. *Streptorhynchus sulcatus*. (Verneuil.)
29. *Streptorhynchus planumbonns*. (Hall.)
30. *Leptæna sericea*. (Sowerby.)
31. *Zygospira modesta*. (Say.)
32. *Zygospira headi*. (Billings.)
33. *Crania scabiosa*. (Hall.)
34. *Pterinea demissa*. (Hall.)
35. *Modiolopsis curta*. (Hall.)
36. *Ambonychia radiata*. (Hall.)
37. *Ambonychia alata*. (Meek)
38. *Cyclonema fluctuata*. (James.)
39. *Murchisonia milleri*. (Hall.)
40. *Murchisonia bellicincta*. (Hall.)
41. *Bellerophon bilobatus*. (Sowerby.)
42. *Endoceras proteiforme*. (Hall.)
43. *Orthoceras halli*. (Miller.)
44. *Asaphus gigas*. (De Kay.)
45. *Calymene senaria*. (Conrad.)

MIDDLE HUDSON BEDS.

46. *Arthraria biclavata*. (Miller.)
47. *Monticulipora mammillata*. (D'Orbigny.)

48. *Monticulipora jamesi*. (Nicholson.)
49. *Monticulipora petechialis*. (Hall.)
50. *Constellaria antheloidea*. (Hall.)
51. *Orthis emacerata*. (Hall.)
52. *Streptorhynchus planoconvexus*. (Hall.)
53. *Glyptocrinus decadactylus*. (Hall.)

LOWER HUDSON BEDS.

54. *Chaetetes fibrosus*. (Goldfuss.)
55. *Chaetetes clathratulus*. (James.)
56. *Stenaster* ?
57. *Heterocrinus simplex*. (Hall.)
58. *Ptilodictya falciformis*. (Nicholson.)
59. *Ptilodictya arctipora*. (Nicholson.)
60. *Orthis emacerata*. (Hall.)
61. *Orthis multisecta*. (James.)
62. *Strophomena alternata*. (Conrad.)
63. *Leptæna sericea*. (Sowerby.)
64. *Zygospira modesta*. (Say.)
65. *Cyclonema bilix*. (Conrad.)
66. *Holopea obliqua*. (Hall.)
67. *Bellerophon bilobatus*. (Sowerby.)
68. *Murchisonia gracilis*. (Hall.)
69. *Orthoceras lamellosum*. (Hall.)
70. *Endoceras proteiforme*. (Hall.)
71. *Ormoceras ventricosum*. (Hall.)
72. *Modiolopsis modiolaris*. (Conrad.)
73. *Ambonychia radiata*. (Hall.)
74. *Asaphus gigas*. (De Kay.)
75. *Calymene senaria*. (Conrad.)
76. *Dalmanites carleyi*. (Meek.)
77. *Acidaspis cincinnatiensis*. (Meek.)
78. *Beyrichia chambersi*. (S. A. Miller.)
79. *Beyrichia oculifera*. (Hall.)
80. *Leperditia minutissima*. (Hall.)

ARCHÆOLOGY.

Long before the advent of the first white settlers in what is now Mason county, the beautiful and fertile valley of the

Ohio river, and the rich uplands which stretched back over the county, were known and appreciated by other people. The river was alive with fish and muscles, the cane-brakes were the homes of many wild and toothsome animals, and wild grapes and nuts hung from many a tree. Wild geese and ducks swam over the waters, and many birds nested in the trees and in the canes. Salt springs existed in several places, and thus every convenience seemed to be provided by nature to aid man in obtaining an easy living and to enjoy the charms of the chase.

These facts are attested by the remains of structures erected for residence, for worship, for defense, or for securing the remains of the dead; and by the great number of arms implements and ornament which have been exhumed from beneath the mold of many years. Many of the most important and interesting of these evidences have been destroyed since the county was formed. Under the heading of *Antiquities*, Collins' History of Kentucky contains the following in reference to some of them:

“On the plantation owned by Samuel Henderson, two miles north of Mayslick, there were, in August, 1837, distinct traces of ancient fortifications. The principal fort contained about one acre of ground; the others were not more than half as large. The walls of these entrenchments were quite plain, as were the marks of trenches or subterranean passages leading to Lee's creek, three hundred yards distant, apparently tunneled to provide a supply of water, secure from danger of a blockading enemy. On about one hundred acres of land, around, the soil, to the depth of one to three feet, was mixed with shells, flints, potter's ware and bones of various descriptions. Among the latter, several entire human skeletons, besides fragments of others, lying about irregularly, as if they had fallen in battle, and been hastily and carelessly buried. The potter's ware, in shape somewhat resembling articles now in common use, was made of muscle shells and stones, pulverized and thoroughly mixed. The vessels were carved on the outside, and remarkably strong, notwithstanding exposure to the elements for centuries. All is conjecture as to the age of

these fortifications; the trees in the several forts, and upon the walls, being quite as large as in the surrounding forest."

"A *Council Chamber* of the aborigines—but who or what they were will always remain a sealed book—was plainly visible as late as 1823, on the east side of the farm of Samuel Frazee, one and a half miles north-east of Germantown, Mason county, Kentucky. It was sunk, or excavated, about eight feet beneath the surrounding surface. Around the sides of this large room were recesses in the walls, forming seats for the council. Here the chieftains of a hundred battles held their councils of war. Mounds and fortifications surrounded this council chamber, though not in close proximity. Stone axes, trinkets and implements were found in and about these ancient works. But the Indians had no knowledge by whom or for what purpose these were made, although they could go back with accuracy for many years, perhaps centuries, by their Wampums, which was the Indian's book of history."

There is much conjecture and no small amount of imagination worked into the above extracts, and it is probable that, if the writers had been in possession of the facts collected by archæologists within the past few years, relating to the habits, structures, etc., of the later Indians and the Mound Builders, these descriptions would have been greatly modified.

There were a large number of mounds within the limits of Mason county; a portion, perhaps the larger number, have been completely destroyed, but some interesting ones are still remaining, and it is to be hoped that they will be preserved for many years to come. However interesting it may be to the student and to the collector to open, explore and describe these structures, and to secure the buried relics of the past, it is of far more interest that some of such ancient tumuli should be preserved, and the records allowed to remain. Posterity has some claim upon antiquity, and the present has no right to entirely obliterate these vestiges of prehistoric times.

Several miles south of Maysville, on the Flemingsburg pike, is quite a large and beautiful mound, which has never been opened. Near Shannon, and surrounded by a cemetery, is

another one of the same character. It was learned, that in digging a grave on or near the latter, some human bones had been thrown out. A smaller structure of like origin is situated in the same neighborhood. On the lands of Mr. H. Brummel, south of Washington, and near the North Fork of the Licking river, used to be a small mound that suffered destruction by being plowed over. A number of relics have, from time to time, been found in and around it, among which several quaint stone pipes. Some two miles north of Washington, there is yet remaining an earthen tumulus left by the ancient people. Not far from Dimmitt Station, and near the Flemingsburg pike, are three mounds—one of them being about double the size of the others.

In the extreme south-eastern corner of Mason, on the farm of Mr. M. D. Farrow, there was, some years ago, one of these piles of earth, from which various specimens of ancient workmanship were plowed up.

Some three miles north-east of Mayslick, on the land of Captain W. P. Fox, is said to have been a very interesting locality, over and around which have been collected many very interesting specimens. A mound is situated near Fern Leaf P. O., and another two miles north east of Minerva. A short distance north of Slack P. O. there is a very neat and symmetrical earthen mound, which appears never to have been disturbed. Again, at Dover there is a considerable mound, and in the Charlestown bottom are three others, while high up Lawrence creek there is one of large size. Several of them used to be at or near Maysville, but they have been entirely destroyed.

The bottoms, but especially the upper bottoms above and below Maysville, have given up a great number of specimens, which many of the plowed fields through, the county have helped to swell in number. Knives, scrapers, arrow-heads, lance-heads, reamers, drills, pestles, axes, pipes, with various other tools, implements of war and ornaments, have been taken from the soil and mounds. The materials of which they were made vary almost as much as the forms into which they were shaped. Hornstone, chert, quartz, jasper, chalcedony, agate, diorite, trap, gneiss, granite, slate, limestone, calcite,

sandstone, cannel coal, barytes, steatite, catlinite, were some of the inorganic substances, while horn, bone, shells and teeth constitute some of the animal materials used. They varied also in the workmanship put upon them, from the roughest chipped tools, perhaps used in agriculture, to the most perfectly and symmetrically made carved images of birds, animals and men, and highly polished articles of ornament.

The materials came from many sources, and in part from long distances, many of them being foreign to the region of the Ohio Valley. It is probable that some of all these were the work of the later Indian tribes, and that others go back beyond them, to a remoter people; but when we reach this part of the subject, we turn into a tangled maze from which there is no satisfactory outlet.

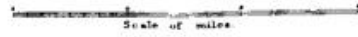
Many of the fine specimens gathered in Mason county have gone to enrich the collections of the north and east, and some have crossed the Atlantic as contributions to the cabinets of Europe. During recent years more interest has been taken in securing the finds for preservation in local collections. The Maysville Historical Society has secured many rare things, and has been enriched by the collections of Col. Fred. Bierbower, Mr. W. D. Hixon and Dr. T. E. Pickett. These and other gentlemen have given much time to the subject, and it is to be hoped that, at some time in the future, they may prepare an illustrated work on the ancient structures and relics found in the county.

GEOLOGICAL SURVEY OF KENTUCKY
John R. Procter, Director.

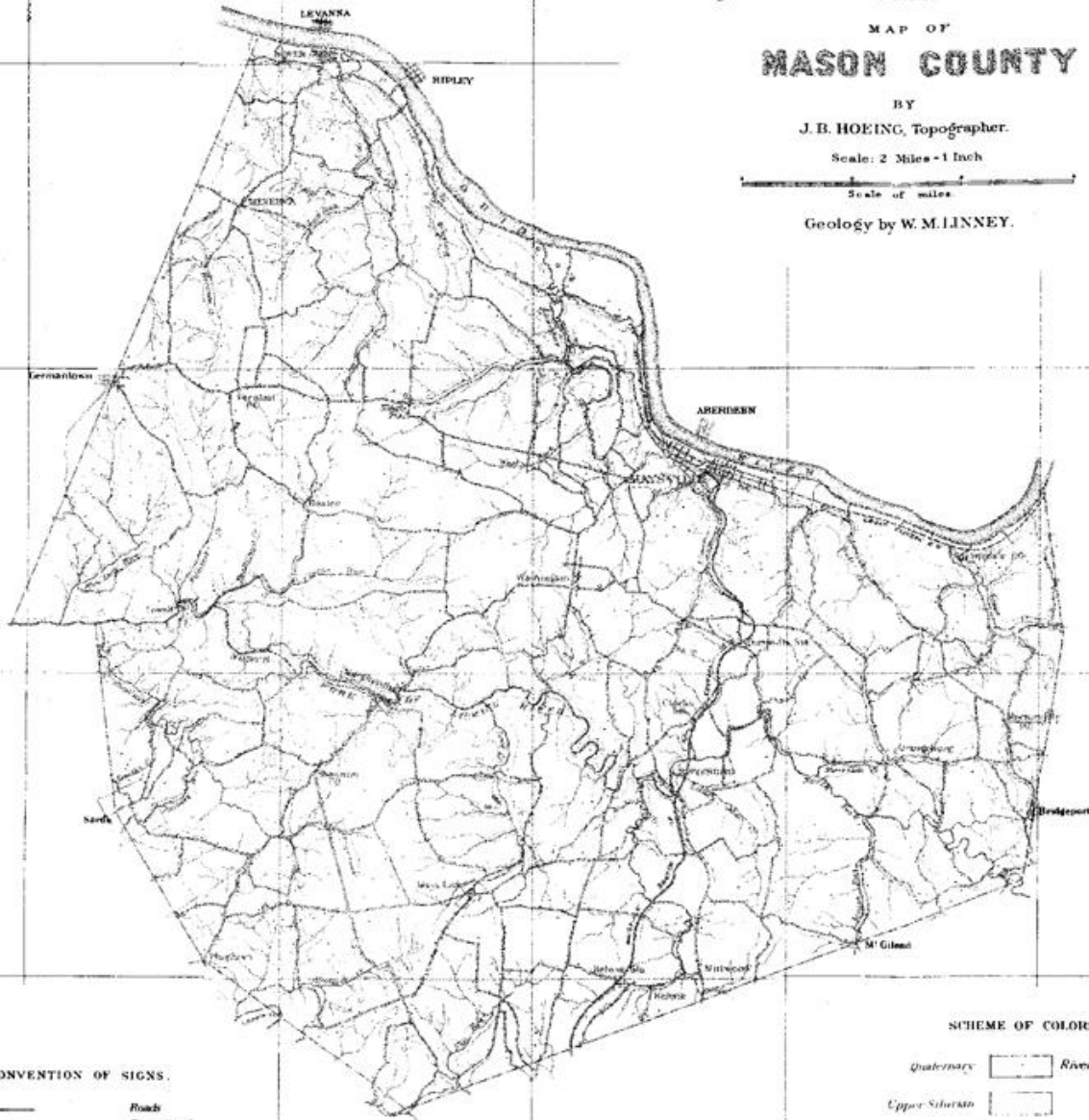
MAP OF
MASON COUNTY

BY
J. B. HOEING, Topographer.

Scale: 2 Miles = 1 Inch



Geology by W. M. LINNEY.



CONVENTION OF SIGNS.

- Roads
- Rail - Roads
- Streams
- Houses
- Indian Mounds
- County Lines

SCHEME OF COLORS

- Quaternary River Alluvium
- Upper Silurian
- Lower Silurian Upper
- Middle Hudson River
- Lower